TITLE PAGE

Surgical catastrophic health expenditure at New Somerset Hospital, a South African public sector hospital

by

Dr. Priyanka Naidu
NDXPRI028

SUBMITTED TO THE UNIVERSITY OF CAPE TOWN
In fulfilment of the requirements for the degree

MSc (Medicine) in Global Surgery

Faculty of Health Sciences

Department of Surgery

UNIVERSITY OF CAPE TOWN

Date of Submission: 8 February 2020

Supervisor: Prof. Kathryn Chu
Department of Surgery, University of Cape Town
Centre for Global Surgery, Stellenbosch Univeristy

Co-Supervisor: A/Prof. John Ataguba
Department of Health Economics, University of Cape Town

DECLARATION PAGE

I, *Priyanka Naidu*, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

I empower the university to reproduce for the purpose of research either the whole or any portion of the contents in any manner whatsoever.

This thesis/dissertation has been submitted to the Turnitin module (or equivalent similarity and originality checking software).

Signature: Signed by candidate

Date: 09/02/2020

ABSTRACT

Background: Catastrophic health expenditure (CHE) and impoverishing health expenditure (IHE) are significant barriers to surgical care. Worldwide, 3.7 billion people risk financial catastrophe if they require surgery, mostly affecting the poorest populations in LMICs. Surgical CHE and IHE are not described in the South African context. The objectives of this study were: 1) to determine the proportion of surgical participants at New Somerset Hospital (NSH)), a second-level public sector South African hospital, who experienced CHE and IHE and 2) to determine the risk factors associated with out-of-pocket (OOP) payments.

Methods: This study used a cross-sectional retrospective questionnaire administered to participants admitted to any department of surgery (obstetrics, gynaecology, general surgery, urology, otorhinolaryngology, or orthopaedics) for a surgical procedure at NSH. Direct healthcare expenditure for the surgical admission was defined to be catastrophic according to three definitions: 1) OOP payments 10% or more of annual household expenditure (HHE) (CHE10); 2) OOP payments 25% or more of annual HHE (CHE25); 3) OOP payments 40% or more of capacity to pay (CHE40). IHE was based on the national poverty lines and was defined according to new impoverishment or worsening impoverishment, as a result of OOP expenditure on the surgical admission. Multivariate regression analysis was used to assess the relationship between OOP payments and per capita HHE, age, type of procedure, department to which participant was admitted, distance from NSH, and length of stay.

Results: Out of the 274 participants interviewed: 263 were included in the analysis (4% attrition rate). Two (0.8%), five (1.9%), and three (1.1%) participants experienced CHE according to the CHE40, CHE10, and CHE25 definitions, respectively. About 98.5% of participants spent less than 10% of their annual HHE, while 95.4% spent less than 10% of their annual non-food expenditure OOP. Median OOP expenditure was R100 (IQR R15 – R350). About 23% of the participants (n=62) were not charged for their surgical admission. Low per capita HHE ($p=0.02$), cancer ($p=0.001$), having a non-generous health insurance plan ($p=0.002$), and the hospital bill amount ($p<0.001$) correlated positively with OOP expenditure on healthcare. Linear regression revealed that there was no correlation between the proportion of OOP payments and LOS or distance. One in five patients (n=50, 19%)

experienced new or worsening impoverishment and were pushed below the poverty line for receiving surgical care at a public hospital. Furthermore, 65 (25%) patients reported their household was unable to cope or household still recovering from the financial burden of the surgical admission.

Discussion: Surgical CHE was not common among this study population, however IHE was substantial and the majority of participants incurred OOP for surgical care, with the main drivers of OOP costs being the hospital bill and transport. Financial catastrophe might have been low because: 1) most participants were protected by the uniform patient fee schedule and therefore did not incur a medical bill and 2) direct non-medical costs did not account for a significant proportion of OOP payments. Understanding the financial impacts of OOP health care expenditure is essential in the planning of the impending National Health Insurance in South Africa.

Abstract word count: 506

ACKNOWLEDGEMENTS PAGE

I would like to thank my supervisor, Prof. Kathryn Chu, for the immense support and mentorship provided throughout this year and for introducing me to the world of global surgery.

I would like to thank my co-supervisor, Prof. John Ataguba for the support, partaking in discussions to standardise and select definitions for catastrophic health expenditure, and always being willing to explain health economics concepts in detail.

I would like to thank Prof. Mark Shrime for his health economics insight particularly with respect to surgical catastrophic health expenditure, assisting in standardising definitions for catastrophic health expenditure for this study, and for reviewing and commenting on results.

I would like to acknowledge Ms. Tonya Estherhuizen from the Department of Biostatistics at Stellenbosch University and Ms. Megan Naidoo for their generous help with statistical analysis of the data and the geospatial analysis.

I would like to thank my husband, Mr. Tashlin Redhi, for his patience and taking the time to revise health economics topics with me.

Most importantly, I would like to acknowledge and thank the participants who participated in this study and contributed to the understanding of OOP health system financing in South Africa.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

Figures:

Tables:

LIST OF ABBREVIATIONS

NSH	New Somerset Hospital
CHE	Catastrophic health expenditure
LMIC	Low- and middle-income country
UHC	Universal health coverage
OOP	Out-of-pocket
UPFS	Uniform Participant Fee Schedule
HHE	Household expenditure
CTP	Capacity to pay
LOS	Length of stay
USA	United States of America
LCGS	The Lancet Commission on Global Surgery
ART	Assistive reproductive techniques

DEFINITION OF KEY TERMS

Catastrophic health expenditure: OOP payments that exceed a certain threshold of a household's income or capacity to pay (CTP), and may be so high that a household must reduce its basic expenditure over a period of time to cope with health costs, threatening a household's survival (1, 2). The definition has varying thresholds based on the proportion of household expenditure (HHE) attributed to OOP payments for the direct costs associated with healthcare, which include: 40% of capacity-to-pay, 25% of total HHE, and 10% of total HHE (3).

Capacity to pay: Also known as non-food expenditure in many cases. The effective income less the household's basic subsistence expenditure, especially food expenditures (4) and reflects a household's purchasing power more accurately than the household income (5).

Poverty: The state or condition in which a person or community lacks the financial resources and essentials for a minimum standard of living (6).

Food poverty line: The amount of money needed for an individual to be able to afford the minimum daily energy intake. This is also known as the extreme poverty line (amount expressed per person per month in rand) and refers to subsistence/food expenditure only (7).

Lower-bound poverty line: The food poverty line plus the average cost of non-food expenditure (amount expressed per person per month in rand) (7).

Upper bound poverty line: The food poverty line plus the average non-subsistence HHE (7).

Gross Domestic Product: Total market value of the goods and services produced by a country's economy during a specific time period (8).

Price elasticity of demand: A measure of the change in the quantity demanded of a product or service in relation to the change in price (9).

Surgical diagnosis: Any diagnosis that constitutes a problem that is potentially surgically treatable. A participant with a surgical diagnosis will be admitted to a surgical service or firm.

Surgical care: Any intervention directed at reducing the disability or premature death associated with a surgical diagnosis (10). Surgical, anaesthetic, and obstetric care is collectively termed surgical care and refers to the care required for surgically-treatable diagnoses (11). Surgical care includes all aspects of care that involve treating a surgical diagnosis, which may or may not require an operation.

Surgical admission: This term is defined, for the purpose of this paper, as the admission during which the participant received surgical care necessitating an operation. It is the acute period during which the participant underwent the operation and recovery period.

Surgical condition: A disease state requiring the expertise of a surgically-trained provider (10). For the purpose of this paper, the surgical condition refers to the disease period prior to the surgical admission during which the participant was interviewed.

Operative admission: A participant is admitted for surgical care which entails an operation. For the purpose of this paper, operative admission refers to surgical admission, as only participants who underwent a surgical procedure during their admission were interviewed.

Inpatient: A participant admitted to the hospital and staying overnight in the wards.

Outpatient: A participant receiving surgical care at a clinic, who does not require to be admitted.

OOP payments: A healthcare financing mechanism that entails direct payments made by an individual to a healthcare provider or service, usually at the time of service use, excluding any pre-payments, for example, taxes and health insurance premiums (12).

CHAPTER 1- INTRODUCTION

SECTION 1.1: GENERAL BACKGROUND OF THE STUDY

Treatment for surgical conditions has long been considered uneconomical worldwide (13). However, in 2015 the Lancet Commission on Global Surgery, along with the World Bank, identified that surgical care is cost-effective and should be prioritised on the global health agenda in order to ensure Universal Health Coverage (UHC) (14).

Catastrophic health expenditure (CHE) is one of the barriers preventing access to surgical care (15). Nearly half the global population is at risk of CHE when accessing surgical care, and this burden of financial catastrophe is often shouldered by the world's poorest populations (15, 16).

Health systems in low- and middle-income countries (LMICs) rely greatly on out-of-pocket (OOP) expenditure to finance healthcare (4). Expenditure is considered catastrophic when a household's OOP payments for healthcare is so high in relation to a household's capacity to pay (CTP) or income, that it results in the household reducing its expenditure on other necessary items to cope with the costs of healthcare (17). Healthcare expenditure may also be impoverishing, either forcing households below the poverty line or deepening poverty amongst the most marginalised populations (2, 18). Impoverishing expenditure is independent of financial catastrophe and impoverishment may or may not occur alongside CHE. Furthermore, avoidance of financial catastrophe can lead to poor health-seeking behaviour.

SECTION 1.2: PROBLEM STATEMENT

In South Africa, there is a paucity of information regarding OOP payments for surgical care, and its impact on financial catastrophe.

Previous literature has shown that South Africans faced negligible levels of catastrophic health expenditure (CHE). In 1995, studies showed that South Africa's CHE for medical care was close to zero (4). The public healthcare sector makes use of the uniform patient fee schedule (UPFS) that subsidises and stratifies user fees at the point of care (19). This guide to billing for services in the public sector, responds to the call from the World Health Assembly to achieve health for all (20). However, it is not known whether the UPFS actually protects against CHE in the public sector.

A recent disease-specific study highlighted that CHE for assistive reproductive techniques (ART) (a highly specialised service) is high in South Africa, and almost half the population experienced financial catastrophe as a result of infertility treatment (2).

Apart from the abovementioned article, there has been no further research published regarding CHE for surgical procedures in the South African public sector. UHC in South Africa cannot be achieved unless there is an understanding of how public sector surgical care is financed.

Section 1.3: Professional significance of the problem

Understanding the factors that contribute to significant OOP payments for surgical care is essential in order to design a healthcare system that protects against CHE. In addition, reducing financial barriers to accessing surgical and anaesthesia care will improve health-seeking behaviours, thereby increasing access to surgical care.

Section 1.4: Overview of the methodology

A 194-item questionnaire was designed on the Research Electronic Database Capturing (REDCap) programme, and included questions that evaluated household income, socioeconomic status, and direct and indirect costs for both surgical admission and surgical condition. The questionnaire was administered over a one-month period in 2019 to all people undergoing a surgical procedure and who were under direct care by one of the surgical

services at New Somerset Hospital (NSH) (obstetrics, gynaecology, orthopaedics, and general surgery – including otorhinolaryngology and urology). NSH is a second-level hospital based in Cape Town City Centre, in the Western Cape, South Africa. All participants who underwent a surgical procedure, were admitted for at least one night to a surgical ward, and were willing to participate in the study following informed consent were interviewed in their preferred language on the day of their discharge. No participants under the age of 12 were included in the study. Data were collated and exported to Stata 15 SE for data analysis.

Three universally-accepted definitions for CHE were used: 1) OOP payments for direct costs associated with surgical care that were 40% or more of annual non-food expenditure, 2) OOP payments for direct costs associated with surgical care that were 25% or more of annual total household expenditure (HHE), 3) OOP payments for direct costs associated with surgical care that were 10% or more of annual total HHE. Expenditure is a commonly used measure in calculating financial catastrophe because it is considered a more reliable measure compared to income, which is subject to acute and dramatic changes over time (21).

Geospatial analysis was performed in ArcGIS to analyse the relationship between OOP payments for surgical care and the area in which the participant lived (suburbs in the greater Cape Town area).

CHAPTER 2 – LITERATURE REVIEW

SECTION 2.1 CATASTROPHIC HEALTH EXPENDITURE - ORIGINS AND DEFINITIONS

Approximately 150 million cases of CHE occur annually as a consequence of accessing healthcare in countries whose health systems fail to protect its individuals against significant OOP payments (17). CHE has been an important topic since the 1970s in the United States of America (USA), where catastrophic health insurance plans were developed to protected citizens against the impoverishing effects of healthcare costs (22). Since then, there have been many studies evaluating CHE in many countries with varying thresholds of CHE. Despite numerous studies published on CHE, there has been a lack of consensus with respect to a universal definition of CHE and a universal threshold against which to measure CHE.

In 1986, Wyszewianski et al, defined CHE as OOP payment for health expenditure that exceeds 15% of the household's income (23). In 1987, a paper was released using the threshold of 10% of household income to determine whether OOP expenditure for health was catastrophic (22), a threshold which was subsequently used by three more landmark papers (24-26). Xu et al used a different threshold of 40% of the household's CTP, which was further endorsed by the WHO (27). CTP not only reflects a household's ability to spend but also accounts for consumer behaviour which has shown that the poorer the household, the greater the share of total income spent on food (28), thereby further putting households already living under the poverty line at greater risk of CHE.

Xu et al defined a poverty line as the average share of household subsistence (food) expenditure (SE) between the 45th to 55th percentile. And therefore, CTP was defined as $CTP_i = EXP_i - SE_{45\text{-}55i}$ (4), where EXP_i is the total HHE and $SE_{45\text{-}55i}$ is subsistence expenditure adjusted for household size.

In 2015, the World Health Organization (WHO) redefined CHE as OOP expenditure greater than or equal to 25% of non-subsistence expenditure (29), while a study by Shrime et al opted

for a threshold of 10% or more of total annual HHE in a multi-country analysis of surgical CHE (30).

Expenditure is a commonly used measure in calculating financial catastrophe because it is considered a more reliable measure compared to income, which is subject to acute and dramatic changes over time (21).

OOP expenditure can be so catastrophic that it may force the household into poverty (4). Financial catastrophe or CHE is related but distinctly different from impoverishing expenditure which is defined as OOP payments for healthcare that force a household that was previously not impoverished, below the poverty line. Impoverishing expenditure can occur independent of whether OOP payments were catastrophic or not, according to the abovementioned definition and thresholds.

There are many limitations to CHE measures. Firstly, the measures only take into account direct medical costs and therefore do not account for indirect, non-medical costs, such as loss of income or decreased economic productivity (30). Further limitations also include the recall bias associated with individuals recalling their expenditure over time and the lack of standardised thresholds (31).

Individuals accessing healthcare may incur a number of costs required to be paid OOP, including: 1) indirect or opportunity costs, defined as any cost incurred when accessing healthcare that does not directly relate to the attainment of health but was incurred as a result of accessing healthcare, such as loss of income or wages and loss of property due to theft (17); 2) direct medical costs are costs associated with the medical bill or the cost of the service (e.g. user fees), these costs can also be incurred as a result of stock-outs and supply shortages in the public healthcare sector and include OOP payments for wound dressings, medication, and assistive devices, amongst others; and 3) direct non-medical costs are expenses incurred in order to access healthcare such as transportation, food, and lodging (15).

In South Africa, the inflation-adjusted national poverty lines for 2019 were R561 per person per month, R810 per person per month, and R1227 per person per month for the food poverty line, lower-bound poverty line, and upper-bound poverty line, respectively. The food poverty line is also known as the extreme poverty line (7). Despite these thresholds being well-defined, the proportion of the South African population pushed into poverty as a result of accessing healthcare services is unknown. However, on a global scale, 100 million individuals are forced below the poverty line due to accessing healthcare (17).

Section 2.2 Distribution of CHE worldwide and its relation to country-spending

LMICs, mostly in South America and Asia, have reported the greatest burden of CHE, with countries such as Argentina and Columbia reporting up to 6% of their households experience CHE, in comparison to HICs such as France and Germany reporting less than 0.05% of households experiencing CHE (4). According to Xu et al, there are three groups with high levels of CHE: 1) countries in transition (Vietnam, Ukraine, and Cambodia), 2) LMICs in South America (such as Columbia, Brazil, Argentina, Paraguay), and 3) countries where there is no form of health insurance or pre-payment towards healthcare (4). Very few studies assessing CHE in Africa have been conducted, however, one study by Ataguba et al reported high levels of CHE among the Nigerian population (31).

A study analysing CHE across 133 countries found the global incidence of CHE to be 11.7% with 808 million people incurring CHE in 2010 (32). Furthermore, the incidence of CHE correlates negatively with the gross domestic product (GDP) per person and the share of GDP spent on health. However, the WHO recognises that the high potential for CHE is attributed more to how a health system is financed and not necessarily the overall spending or income of the country (33), yet the poorest countries still experience the greatest CHE.

Many countries do not have a national health insurance plan that offers financial risk protection for their inhabitants and the poorer the country, the greater the proportion of healthcare financing attributed to OOP payments (31). As a result, in many countries worldwide, healthcare financing is predominated by OOP payments, which tend to have

devastating effects on individuals from all income levels, but the poorest quintile are particularly vulnerable, experiencing CHE up to 61 times more often than wealthier quintiles (15). Individuals in the poorest quintile are already the most vulnerable populations and often the sickest (34), and therefore further predisposed to impoverishment (15, 16, 34).

Section 2.3 Health economic principles and health systems financing

Healthcare is financed in a multitude of ways: OOP payments in the public and private sectors, health insurance plans (both public and private), national social insurance plans (collection of premiums from households), and government funding through national taxation (35). Even when insurance is available, it often does not protect against the non-medical costs associated with accessing healthcare that result in more annual cases of CHE than direct medical costs alone (15, 36), with the poorest populations being the most vulnerable (37). Marginalised populations often live in remote and rural areas, far from healthcare facilities and public transport (38). These populations are also, often, not protected against leaves of absence, resulting in substantial opportunity costs due to loss of income (38).

In the public sector, user fees may be used to generate sufficient resources and funding for continued healthcare provision for an expanding population and to ensure financial sustainability in the healthcare system (39). Private sector healthcare worldwide relies heavily on direct payments OOP; OOP payments are incurred for services that are not covered by health insurance and for the co-payments that individuals pay (16).

User fees have the potential to cause financial catastrophe. Abolishment of user fees has been shown to result in an increase in health service use in some countries. For example, in Sudan, the abolition of user-fees appeared to be associated with an increase in the percentage of individuals accessing obstetric services for caesarean section delivery (40). In Sierra Leone, there was a five-fold increase in the use of under-five paediatric healthcare services and in China, the cataract surgery services doubled after the removal of user fees (41, 42). While free healthcare can alleviate financial catastrophe associated with OOP healthcare expenditure, not all healthcare systems are sustainable in this manner and not all conditions

show increased utilisation as a result of free healthcare, implying that some conditions are more price-sensitive than others (40). Furthermore, abolishing user fees may result in free healthcare but has no bearing on the quality of healthcare received (40).

Previously, user fees were viewed as a crucial component of healthcare financing in Africa, in addition to, or sometimes in lieu of, tax-based financing (43). However, in many African countries user fees have now been abolished, particularly for primary healthcare services and vulnerable populations such as pregnant women, children, and the elderly (43). In 1987, the United Nations Initiative Children's Equity Fund (UNICEF) and the World Health Organization sponsored the Bamako Initiative, was adopted by many African Ministries of Health to increase primary health care service delivery and improve the efficiency of the resource-limited health care sector. This initiative aimed to increase donor support, and increase government spending health care and combine this with the concept of community funding. The initiative was implemented in and tailored for many African countries, but all with the same core objective of providing a minimum or basic healthcare packages to meet basic community health needs through user fees and community co-management of funds (44, 45). However, this initiative had substantial limitations with respect to imposing user fees on poorer households and cost recovery methods were called into question, resulting in an initiative that was not often not scalable in many countries (45, 46).

In South Africa, the UPFS was designed to protect participants in the public sector against CHE due to direct medical costs (47). This system stratifies user fees according to participant income and ability to pay, including fully subsidised health service users (48).

Pre-payments have been identified as a way to protect against financial catastrophe. Examples of pre-payment methods include national and social health insurance or contribution based on risk pooling, where premiums are collected from residents, and private health insurance, which is often costly (15). Private health insurance is a costly method of health system financing, and drives inequities in healthcare, particularly in accessing surgical care which is mistakenly perceived as uneconomical (49).

Government funding is still crucial, particularly in LMICs where a large proportion of participants are spread out over large distances geographically, often in remote areas, earning low-incomes or living below the poverty line. A national or social health insurance is not always feasible in these settings as generating sufficient funds is difficult and has often not led to adequate provision of healthcare services (15).

The health economics concepts of price inelasticity and the theory of supply and demand play critical roles in CHE. Assumptions made in assessing financial catastrophe include: 1) Healthcare costs are financed out of current income, and 2) health expenditure is seen as necessary and non-discretionary (i.e. based on the economic theory of price elasticity) (50).

Price elasticity of demand is a measure of the degree to which the quantity demand of a product or service responds to changes in its price. Healthcare, especially essential and emergency care, is assumed to be a necessity and the degree to which the individual or community responds to price is less elastic. Thus, the demand for healthcare is considered price inelastic (51, 52), which means that despite increases in the price of healthcare, demand does not decrease proportionately, as it is perceived to be a necessity.

Section 2.4 Factors affecting catastrophic health expenditure

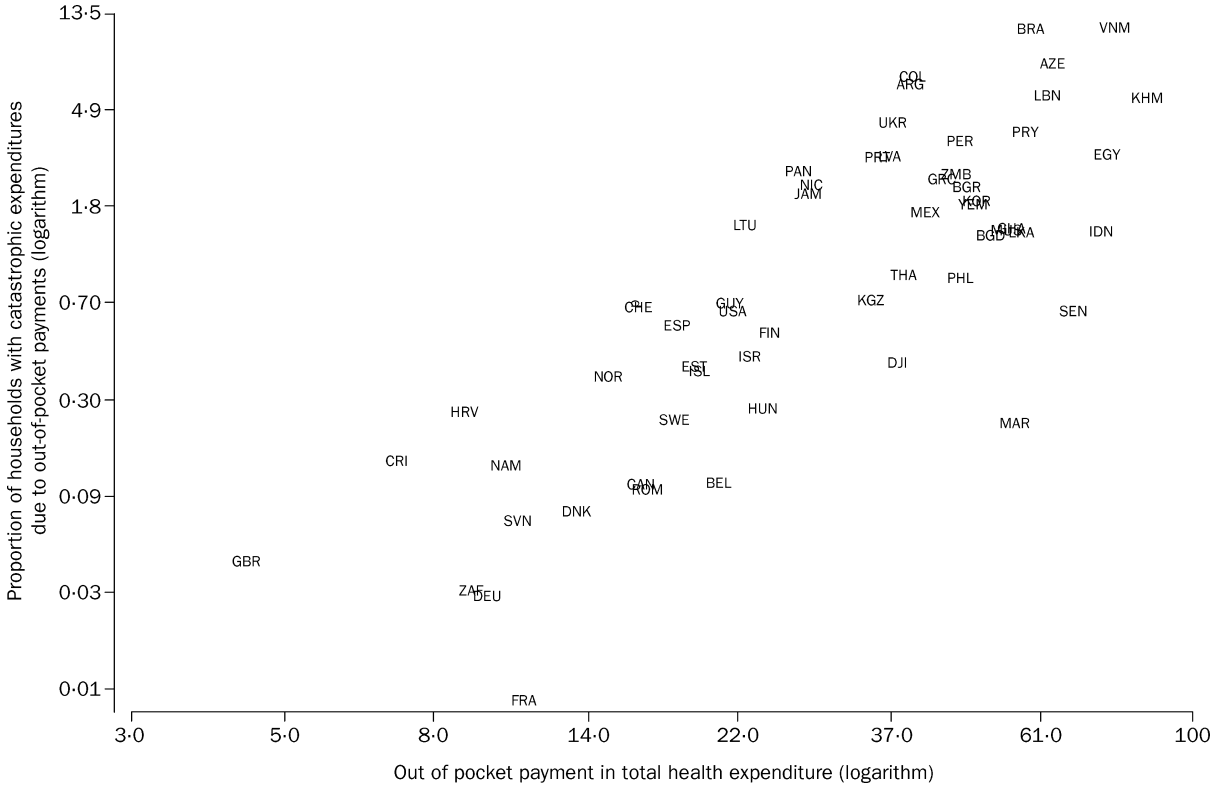
In high-income countries, such as the USA, factors that predispose to CHE include houses headed by persons older than 65 years of age, persons with disabilities, being unemployed, and lack of health insurance (53, 54). Risk factors for CHE in other countries, especially African countries, have not been well described in the literature.

In a study by Xu et al, three major determinants of CHE were identified: 1) OOP payments share of total health expenditure, 2) total health expenditure share of GDP, 3) proportion of households below the poverty line (4).

There was wide variation between countries with respect to CHE. However, the analysis showed that CHE is common in middle-income countries, countries in transition, and in several low-income countries (4). The triad of poverty, lack of health service access and use, and the failure of social mechanisms to pool financial risks account for most of the variations in CHE across countries (4).

The poor have been repeatedly found to be more predisposed to pay for their healthcare OOP (15, 36, 55). In low- to middle-income countries, such as Thailand, factors that predispose households to CHE included poverty or low household-income, which increases the risk of health expenditure being catastrophic in already marginalised populations (4). Increased OOP expenditure has been shown to correlate positively with an increase in CHE (4). A one percent increase in OOP payment toward healthcare expenditure correlates with a 2.2% increase in a household experiencing financial catastrophe. Figure 1 is taken from Xu et al illustrates this relationship between OOP payments and CHE (4). Even relatively small OOP payments can be catastrophic for poor households (56), with the poorest participants being up to 61 times more likely to experience CHE compared to wealthier participants (15). This vulnerability is attributed to the fact that poorer households use almost all their income and resources for basic needs, such as subsistence, and often do not have the financial capacity to save for potential healthcare needs (56). As a result, no matter how low the OOP expenditure on healthcare, they are often less able to cope with OOP payments for healthcare in comparison to wealthier households. Furthermore, poorer populations often do not have the financial capacity to afford health insurance prepayments to supplement healthcare expenditure; resultantly, the proportion of OOP payments for healthcare, and the potential for CHE, is higher.

Figure 1: Proportion of households with CHE versus the share of OOP in total health expenditure (multi-country analysis)



Source: Xu et al. Household catastrophic health expenditure: a multicountry analysis. 2003. Online available:

Section 2.5 Surgical catastrophic health expenditure

Surgical care has been reported as an important condition leading to financial catastrophe in healthcare (57), accounting for approximately one-fifth of CHE cases (30) and affects households of all income levels and countries at varying stages of development (17).

The Lancet Commission on Global Surgery (LCGS) noted that there are five billion people worldwide who lack access to safe, timely, and effective surgical and anaesthesia care, most of whom reside in low- to middle- income countries in Africa (15, 58). Furthermore, about one-third of the global burden of disease is attributed to surgical conditions (15). As a result of advocacy from organisations such as the World Bank, the LCGS and the World Health Assembly, this formerly neglected burden of surgical disease has been proven to be cost-effective and is being prioritised on the global health agenda, with the view to address this unmet need by 2030 (15, 58). Even though surgery is cost-effective for health systems, it is

not necessarily affordable for the participants accessing surgical care, particularly if there are no pre-payment or national health insurance policies to protect against the financial catastrophe of accessing surgical care (15). The need for surgical care, particularly in LMICs, is often an acute emergency, unpredictable and life-saving, making it difficult to plan and save for (30). Due to the nature of surgical conditions, accessing surgical care often results in large immediate or upfront costs that result in CHE even if the participant has health insurance, particularly if most of the costs are non-medical and not reimbursed by the insurance.

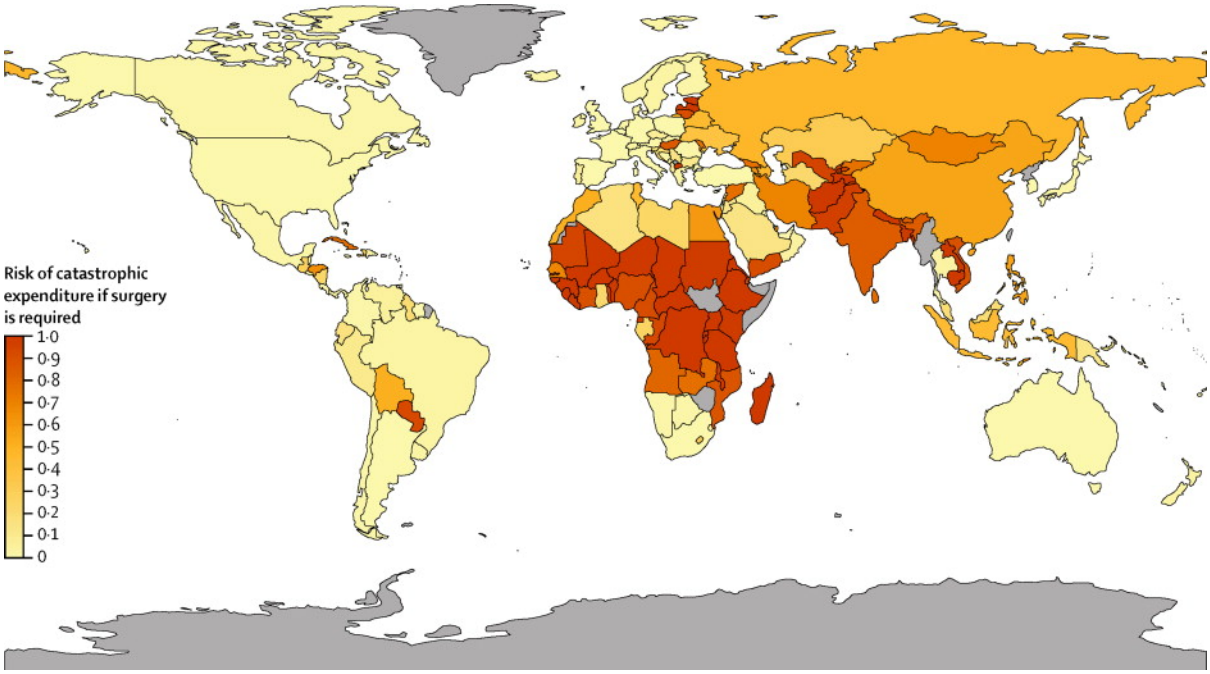
In 2015, the LCGS identified that approximately 33 million individuals experience financial catastrophe due to OOP payment for surgical and anaesthesia care, annually. Key stakeholders present during the Commission identified user fees as the predominant method of health systems financing for surgical care in many LMICs, particular in Southeast Asia and sub-Saharan Africa, and consequently a significant barrier to accessing surgical and anaesthetic care (37, 59). Despite certain countries having a health insurance plan funded through general taxation, these plans often do not include the bulk of surgical and anaesthesia care and still require healthcare financing to be funded OOP (60). Furthermore, health insurance plans very rarely cover the non-medical costs associated with accessing surgical care (15, 36).

User fees at the point of care often result in substantial adverse effects, especially in low-income households, such as decreased utilisation of healthcare services and increased morbidity and mortality (37, 61-63). This is often exacerbated by the acute nature of surgical conditions and by non-medical costs, such as transport, which need to be paid upfront and often cannot be financed over time.

A global modelling study by Shrime et al in 2015 aimed to quantify this burden further and found that nearly half the global population is at risk of CHE due to accessing surgical care (30). The study further confirmed the findings of the LCGS (see figure 2 below) (30), showing the worldwide distribution of the risk of CHE if surgery was required. With a risk of 0.5 representing that, an individual has a 50% chance of incurring financial catastrophe if surgery were required. Another study by Hamid et al found that 3.4% of the global

population is forced into poverty annually as a result of non-communicable diseases requiring emergency care, including surgical conditions. In rural Bangladesh, surgical conditions account for half of the most impoverishing conditions and included undergoing surgical procedures such as cholecystectomy, appendectomy or hysterectomy (57). In North India, 30% of participants who sustained injuries experienced CHE (64). In Africa, OOP expenditure for surgical care is often catastrophic. In Malawi, CHE affected 94% of patients attending district hospitals and 87% of patients attending central hospitals for surgical care with non-medical costs (such as transport and food) and indirect costs (such as loss of income) contributing substantially to financial catastrophe (65). In Uganda, 16% of of participants experienced CHE as a result of direct costs for pediatric surgery, however up to 27% of participants experienced CHE due to indirect costs (66). Another Ugandan study found that up to 31% of participants experienced CHE and 53% of households had to borrow money to finance OOP expenditure on surgical care (67). While the occurrence of surgical CHE in LMICs has gained much attention, HICs like the United States also report high levels of CHE among their uninsured patients. The risk of financial catastrophe is highest among severely injured patients, often requiring surgery, and was found to occur in up to 81.8% of participants and the poorest quintile were disproportionately affected (68).

Figure 2: Risk of catastrophic health expenditure if surgery is required



Source: Catastrophic health expenditure to pay for surgery world : a modelling study https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(15)70085-9/fulltext?code=lancet-site

Additionally, 48.5 million cases of CHE annually are attributed to the non-medical costs associated with accessing surgical care, such as transportation to the healthcare facility, food, and accommodation, amongst others (30, 69, 70). Despite the non-medical costs accounting for a significant proportion of CHE cases annually, these costs are often not factored into the models for determining and analysing OOP expenditure for healthcare.

One-quarter of individuals worldwide will incur CHE as a result of seeking surgical care, and in keeping with previous literature on CHE, this burden is consistently higher in LMICs, affecting the poorest populations (15). The burden of CHE often falls on the country's poor, and this is most notable amongst the poorest participants in upper-middle to high-income countries, where almost all CHE falls on the poor (15). Worldwide, approximately 6.1% of the poorest participants experience CHE due to accessing surgical and anaesthetic care (30). In contrast to low-income countries, Shrime et al found that the greatest CHE was experienced in upper-middle to high-income countries, suggesting that as the economic status of a country improved, OOP payments for surgical care were more likely to increase disproportionately to household income.

Numerous organisations, such as the World Bank and the WHO, have noted that protection against CHE is an important aspect of ensuring UHC. These organisations are urging countries to target 100% financial risk protection against CHE, due to OOP payments for healthcare, by 2030.

In order to do this, a situational analysis of health system financing and CHE is required in each country. The LCGS named six core indicators that would serve as measures of access to safe, affordable surgical and anaesthesia care and that need to be collected in order to understand the burden of unmet surgical need worldwide. The last two indicators relate directly to CHE: the risk of impoverishing expenditure when surgery is required and the risk of catastrophic expenditure when surgery is required (58, 71).

There is limited data available on the OOP financing for surgical and anaesthesia care. Not only is the incidence of CHE not well described, but an understanding of how surgical and anaesthesia care is financed within various health systems worldwide is lacking. There needs to be more granular data on the impact of surgical care on financial catastrophe, especially in Africa.

Section 2.6 Implications of catastrophic health expenditure

Households that spend 50% or more of their annual non-food expenditure on OOP payments for healthcare are likely to experience impoverishment (33). Many participants who experience CHE will be pushed into impoverishment, and those who wish to avoid impoverishment might choose not to seek healthcare rather than risk catastrophic financial implications (43, 72, 73). The most at-risk populations for financial catastrophe are often the poorest populations in LMICs, further impoverishing the most vulnerable and marginalised. The financial catastrophe caused by OOP payments for healthcare can have devastating effects on households, forcing them to sell valuable assets, borrow money, and reduce spending on other necessities such as food and shelter (74).

Medical and non-medical costs of accessing healthcare, especially surgical care, can result in adverse health-seeking behaviour in order to avoid financial catastrophe or impoverishment due to OOP expenditure (3).

There are consequences associated with not seeking care, particular for surgical conditions can be life-threatening. The adverse effects of not seeking care include further morbidity and inability to work, resulting in financial hardship and lack of economic productivity (3, 4).

Disability- and quality-adjusted life years are common measures of healthcare effectiveness but do not explicitly account for the impoverishing effects of accessing medical care.

Therefore, these factors and subsequently, their consequences, are under-researched and reported.

SECTION 2.7 PROTECTING AGAINST CATASTROPHIC HEALTH EXPENDITURE

The effects of CHE can be so debilitating for a household that health systems have been designed to protect against CHE. In 2000, the World Health Report noted that it is the responsibility of a country's health system to ensure a finance system that protects its population against catastrophic health expenditure (1). Many health systems and insurance policies in both high- and low- to middle-income countries have been designed to protect participants against CHE (26, 49, 75). Issues of health financing are gaining attention in many LMICs and becoming more central to policy-making (31), this is notable with the National Health Insurance (NHI), a priority policy in South Africa. However, despite increased awareness around health financing issues in Africa, OOP payments remain substantial in many LMICs (31). Factors affecting the development of healthcare financing plans that protect against CHE include weak institutional capacity, political instability, poor socioeconomic conditions, poor healthcare infrastructure, lack of information and data to incite policy change (76, 77). Furthermore, the lack of data in LMICs on the incidence of CHE based on income levels and socioeconomic status is one of the most significant barriers hindering appropriate policy development (31). As described previously, CHE tends to affect the poorest populations disastrously and disproportionately. Ataguba argues that it is crucial to develop fair indices of CHE, with thresholds that are different depending on income levels, to address the principle of vertical equity and account for the poorest populations (31). Defining CHE using the same fixed proportion (i.e. threshold) of household income or expenditure for all households is inadequate as even small amounts spent OOP on healthcare could be disastrous for poorer households (25, 31).

Despite the paucity of literature on the stratified incidence of CHE, there have been some concrete suggestions to protect against CHE. The multi-country analysis by Xu et al found that, if OOP payments on health expenditure could be reduced to less than 15% of total health spending, CHE could be avoided in most households (4). This would require more detailed health systems planning. However, the multicountry analysis by Xu et al did not account for

the direct and indirect non-medical costs associated with OOP expenditure for healthcare, such as transport, accommodation, loss of income, and food costs (4). The finding by Shrime et al that shows financial catastrophe to be more common amongst upper-middle to high-income countries, suggests that financial risk protection against CHE should be built into health systems in countries at all stages of development (30).

Non-medical costs should not be overlooked as an important contributor to CHE, as described earlier. These costs can be more impoverishing than the direct medical costs associated with accessing care, and surgical care in particular. These costs are often overlooked because they are not documented or well-researched and therefore, not budgeted for. Interestingly, a previous study by Shrime et al found that free healthcare at point of care did not protect the poorest populations against CHE; however, when vouchers were provided to assist participants with the non-medical costs associated with surgical care, there was an increase in overall health benefits and a substantial increase in financial risk protection (36).

User fees are often implemented in order to sustain a healthcare system financially but do not assist in achieving equity, sustainability, or efficiency (43). Furthermore, if they result in CHE or impoverishing healthcare expenditure, the impact is significant for both the individual and the country's economy. If individuals are avoiding the use of healthcare services due to the fear of incurring CHE, the individual and household will suffer further worsening healthcare and might be unable to attend work, and this will have a negative impact on the country's effective workforce and productivity.

In Sierra Leone, the cost of surgical care was seen as a financial burden requiring participants to often borrow money for OOP payments at point of care. This creates a substantial barrier to accessing surgical care, particularly if the provision of surgical care is not perceived to be of good quality or cost-effective (37).

A healthcare system that ensures financial risk protection also addresses inequities in accessing healthcare, ensuring that poverty is not deepened amongst marginalised populations. In order to achieve this, a country's healthcare system should combine various

methods of financing to both ensure system sustainability and prevent financial catastrophe (15). In addition to income-stratified user fees, pre-payments through general taxation and private insurance contributions should also form part of health system financing to distribute risk and minimise OOP payments when people become ill (61). However, there is great variation in how a government spends on healthcare and the priorities given to specific conditions within healthcare, resulting in deep inequities, especially for surgical procedures which are often not prioritised in national health insurance plans or benefits packages (15, 57).

Rwanda is an example of where health insurance schemes support a UHC model. The implementation of a national community-based health insurance policy has assisted in achieving >90% health coverage for the Rwandan population; funded mostly by the government and external funding (49). The public is required to pay annual premiums (tiered according to household income) and co-payments up to 10% at the point of care, which have been subsidised for the poorest quarter in the country (49).

The success of this combination of financial risk pooling methods is an important lesson for other LMICs, particularly in Africa. Without financial risk pooling that accounts for both the direct medical and non-medical and indirect (opportunity) costs of healthcare, the goal of UHC cannot be achieved.

More importantly, health systems financing cannot be tackled in isolation. The barriers to accessing surgical and anaesthetic care are numerous and complex; even if financial risk pooling is applied to surgical and anaesthetic care, lack of service provision and difficulties getting to surgical care, amongst other barriers, may still hinder safe, effective surgical and anaesthetic care to the poorest populations (15). Another important concept to consider is that often autonomy in the decision-making process is impacted by individuals who live in households where decisions are collectively made. This is an important barrier, especially for surgical care, that might not always be perceived as necessary or cost-effective. Income and expenditure in poor households are often shared and as a result, the decision-making process is often shared; increased autonomy of a household member may result in increased utilisation of healthcare services (37).

SECTION 2.8 WHAT IS KNOWN ABOUT CATASTROPHIC HEALTH EXPENDITURE IN SOUTH AFRICA?

In 2018, South Africa was reported as the most unequal country in the world according to the World Bank, with 30-million people living below the national upper-bound poverty line, this represents more than half of South Africans (55.5%). Deep inequities still exist in South African society post-apartheid, with the groups worst affected by poverty identified as female-headed households, black South Africans, the unemployed, the less educated, large families, and children (78). Interestingly, the World Bank reports that poverty is not only widespread but has increased since 1994 and is still distributed geographically, eluding to the legacy of Apartheid (78). Furthermore, inequality and chronic poverty in South Africa are further driven by high levels of income-polarisation, compounded by the high levels of unemployment – up to 30% in South Africa (78).

These inequities run even deeper in the healthcare sector, particularly with respect to the private and public sectors. The majority of doctors (70%) in South Africa are concentrated in the private sector, which 80% of the population cannot access (79). The public sector in South Africa services this 80% of the population that do not have private health insurance, but despite this, the South African Government's spending on healthcare accounts for less than half of total health expenditure. Understanding the dynamics in South Africa's economy is crucial to interpreting CHE and future policy development to protect against it.

Ataguba et al found that inequities further favour the richer individuals and households in South Africa. The relatively wealthier groups in both public and private health sectors receive a greater share of the benefits, despite having a lower disease burden (35). In 1992-1993, it was estimated that direct household payments contributed to 23% of health system financing (80). A study by Harris et al quantified this inequity in the South African health system, showing that 43% of uninsured individuals, who utilised public sectors services, experienced financial catastrophe compared to 4% of privately-insured individuals who utilised services in the private sector. A study by McIntyre et al demonstrated that up to 18% of OOP payments by participants utilising the public sector were attributed to user fees (81). Furthermore, the OOP non-medical costs have been reported as a substantial barrier to

accessing healthcare in South Africa, particularly with respect to transport costs and distance from facilities (16).

Despite the significant inequality gap in South Africa with vast inequities between the public and private healthcare sectors (16), CHE has been found to low in South Africa. The study by Xu et al that evaluated 116 household surveys over a 13-year period in 89 countries discovered in 1995, South Africa was reported to have an almost zero incidence of CHE (17).

However, despite CHE being low, it has been shown that the poorest populations shoulder the greatest burden of OOP payments and financial catastrophe in South Africa (16). Contrastingly, one study by Dyer et al published in 2013 assessing CHE associated with assistive reproductive techniques (ART) found a 51% incidence of CHE, affecting the poorest populations (2). It was further discovered that 42% of the participants borrowed money to assist with their payments, which was often required to be paid back with interest (2). However, it is essential to understand that ART is a highly specialised elective procedure mostly sought in the private sector and is not covered by health insurance, resulting in high OOP costs. This is not representation of the OOP costs attributed to essential and emergency surgical procedures. However, other procedures like ART should be investigated in the private sector to see their impact on CHE.

In a multi-country analysis by Xu et al, most African countries were excluded because household surveys and national registries did not record the information associated with expenditure (4). It was presumed that African countries were similar to other LMICs such as the South American countries that experienced significant OOP expenditure, which correlated to significant CHE.

The South African government has proposed the introduction of a national health insurance plan in hopes of attaining UHC for South African citizens and addressing the inequities between the private and public health sectors (82). However, surgery and anaesthesia care, although implicitly in the plan, are not mentioned explicitly in the most current version of the NHI Bill, and therefore is at risk of not being prioritised.

There is limited data on CHE in South Africa and no current literature on CHE for surgical care. Furthermore, the previous studies have derived their information from household surveys that often do not capture information on non-medical costs.

Section 2.9 A summary of previous research and how it relates to this study

In summary, previous literature published outside of South Afria has shown that CHE is a barrier to accessing healthcare, particularly with respect to surgical and anaesthetic care. Nearly half the global population is at risk of experiencing financial catastrophe as a result of seeking surgical or anaesthetic care. Health systems are often financed through OOP payments and user fees, particularly in Africa, and if the health system does not account for financial risk protection, then many households could be pushed into poverty or financial catastrophe as a result of accessing surgical and anaesthetic care. This has been identified as an important indicator by LCGS, as surgical conditions are often acute and emergency conditions, requiring upfront OOP expenditure, especially for non-medical costs.

There are few reports on CHE in South Africa. In 1995, a study published in South Africa found CHE to be close to zero . The reasons for this need to be further explored. These estimates were not disease-specific and little is known about OOP expenditure for surgical care. South Africa currently does not offer universal financial protection through a national health insurance plan. Of greater concern, the proposals for the NHI bill currently make no explicit mention of coverage for surgical conditions or financial risk protection for surgical and anaesthetic care and procedures. Due to the lack of conclusive evidence of CHE in South Africa, and surgical care in particular, it is still important to study OOP and CHE, as it may not be as insignificant as the previous study suggested (3).

The LCGS identified that five billion people worldwide lack access to safe, affordable, and effective surgical care, most of whom reside in LMICs in Africa . Since 2015, the Commission, along with the WHO, the World Bank and the World Health Organization, have been lobbying for surgery, anaesthetic, and obstetric care to become priorities on the global

health agenda. One of the barriers to accessing surgical care is the risk of financial catastrophe and CHE measures serve as an indicator of access to surgical care.

There have been very few studies on CHE in South Africa, and of those published, no data are available to quantify surgical CHE. Furthermore, most studies are modelling studies based on national household surveys. This gap in knowledge of surgical CHE in South Africa could have substantial adverse effects on already marginalised populations. If surgical CHE is significant, this could have implications for surgical care in SA and this information would be critical for NHI planning in South Africa. Currently, the NHI cannot be informed on the need to protect against surgical catastrophe if there is no evidence or literature providing information on surgical CHE.

Table 1: Summary of relevant literature published on surgery- and anesthesia-related catastrophic health expenditure in South Africa

Author and Title	Year	Objective	Methods	Key results	Link to study
Dyer S, Sherwood K, McIntyre D, Ataguba J. Catastrophic payment for assisted reproduction techniques with conventional ovarian stimulation in the public	2013	To determine how often out-of-pocket payment (OPP) for assisted reproduction techniques (ART) with conventio	A prospective observational study at Groote Schuur Hospital (an urban, public/ academic level 3 hospital) comprising 135 couples undergoing ART between	- One in five couples (22%) incurred catastrophic expenditure ($P < 0.01$), - Households used a range of coping strategies including reduced expenditure on items such as	https://academic.oup.com/humrep/article/28/10/2755/620126

health sector of South Africa: frequency and coping strategies		nal ovarian stimulation results in catastrophic expenditure for households.	March 2009 and June 2011 was conducted. Catastrophic health expenditure was defined as OPP of ≥40% of annual non-food expenditure.	clothing and food, use of savings, borrowing money and taking on extra work. - Differences were observed between the socio-economic tertiles: in the poorest tertile, 51% of households faced catastrophic costs compared with only 2% of the richest tertile ($P < 0.01$). - Risk factors for CHE in among the poorest tertile were race (black) ($P < 0.01$), lack of health insurance ($P < 0.01$), female	

				full-time employment ($P < 0.01$), and longer duration of infertility ($P < 0.05$).	
Dyer S, Vinoos L, Ataguba J Poor recovery of households from out-of-pocket payment for assisted reproductive technology	2017	To determine how households recover financially from direct out-of-pocket payment for government subsidized ART.	An observational follow-up study was conducted ~4 years later to assess financial recovery among the 135 couples who had participated in this previous study. Data were collected over 12 months from 73 informants.	- There was poor recovery after a mean 3.8 years - The recovery rate was below 50% - 23.1% of households had re-purchased a sold asset; - 23.5% had normalised a previous reduction in household spending, - 33.8% had regained their savings, and - 48.7% no longer had to take on additional work. - Two-thirds of households (60.0%) had	https://academic.oup.com/humrep/article/32/12/2431/4560626

				repaid all loans and debts. - In comparison with the richest tertile, the poorest households showed lower rates of recovery	
Xu K, Evans D, Kawabata K, Zermandini R, Klavus J, Murray C Household catastrophic health expenditure: a multicountry analysis	2003		South Africa was one of the countries studied in a cross-country analysis design. Data from household surveys in 59 countries were used to explore, by regression analysis, variables associated with catastrophic health expenditure. Catastrophic health	- South Africa's rate of catastrophic health expenditure was close to zero (0.03%).	http://digicollection.org/hss/documents/s15754e/s15754e.pdf

			expenditure for health care (not surgical care specifically) was defined as a household's financial contributions to the health system exceeding 40% of income remaining after subsistence needs have been met. Results were based on data from 1995 household surveys.		

CHAPTER 3 – AIMS AND OBJECTIVES OF THE STUDY

SECTION 3.1 AIM

This study aims to assess OOP expenditure for surgical care and determine if CHE is incurred as a result of accessing surgical care at NSH, a second-level public sector hospital in Cape Town. The study also aims to determine risk factors associated with OOP expenditure. To our knowledge, this will be the first study looking at CHE for surgical care in South Africa.

SECTION 3.2 RESEARCH QUESTIONS

Main objective:

To identify the proportion of surgical participants at NSH that experience CHE and Impoverishing Health Expenditure (IHE);

Secondary objectives:

1) To determine the main contributing costs to OOP expenditure for surgical admission;
2) To assess strategies used to finance OOP payments for surgical admission;
3) To identify risk factors associated with OOP expenditure for surgical admission;
4) To understand the perceptions of participants accessing surgical care.

CHAPTER 4: METHODOLOGY

SECTION 4.1 STUDY DESIGN

This was a cross-sectional observational study administered via questionnaire. The questionnaire was designed in Research Electronic Data Capturing software (REDCap 8.4.3 Vanderbilt, 2019) and contained 194 items under the headings: 1) Participant information, 2) Household member information, 3) Household socioeconomic status, 4) Information on inpatient and outpatient surgical care, 5) Coping with surgical expenditures, 6) Access (to NSH), and 7) Follow-up calls on medical bills and coping with healthcare expenditure. See appendix 1 for the detailed questionnaire. The questionnaire was modified from a previous study that assessed catastrophic health expenditure in assistive reproductive techniques (2).

SECTION 4.2 RESEARCH SITE

The study was conducted at NSH over a one-month period from 4 March 2019 – 4 April 2019. Founded in 1864, NSH is a second-level/regional hospital in the Cape Town Metro Health District, South Africa with a catchment of approximately two million people. The hospital is a 330-bed facility located in an urban setting and has four operating theatres. Two first-level/district hospitals refer to NSH (Vredenburg Hospital and Wesfleur Hospital), as well as many other clinics in the Cape Metro West region (83). NSH has six specialist surgical services offering 24 hours services for obstetrics, gynaecology, orthopaedics, general surgery, otorhinolaryngology, and urology. Obstetrics and gynaecology have three full-time consultants (qualified specialists). General surgery has three full-time consultants, orthopaedics has two full-time consultants, and urology and otorhinolaryngology each have one consultant each. All surgical services have teams of registrars, medical officers, and interns.

NSH is a public hospital and therefore offers free services to the following individuals: 1) pregnant and breastfeeding women, 2) children under the age of six years, and 3) pensioners above the age of 65. Other participants are billed according to the UPFS.

SECTION 4.3 PARTICIPANTS

A power calculation was based on the World Bank's World Data Indicators in 2017 that estimated South African CHE to be 15% and IHE to be 27%. Based on the IHE of 27%, to achieve 80% power and find a 20% difference in IHE with an alpha value of 0.05, we would need to interview at least 42 patients.

Section 4.3.1 Inclusion criteria:

- All inpatients from one of four surgical departments: obstetrics, gynaecology, orthopaedics, and general surgery (which included otorhinolaryngology and urology) who underwent a surgical procedure in the operating theatre under anaesthesia (general or regional).
- All participants above the age of 12 were included in the study. Participants between ages 12 -16 had informed consent co-signed by their parents or guardians.

section 4.3.2 Exclusion criteria:

- Minors (defined as younger than 12 years of age).
- Inpatients admitted to the surgical ward but had not undergone a surgical procedure in a operating theatre under anaesthesia.

section 4.4 Ethics approval

Ethics approval was obtained from the University of Cape Town (UCT) Human Research Ethics Committee (HREC 619/2018), granted until 30 October 2020. Following ethics approval, permission was obtained from the relevants department heads at NSH and the Western Cape Provincial Department of Health.

section 4.5 Participant confidentiality

Participants who agreed to participate were interviewed on the day of their discharge. Informed consent was obtained in their preferred language. Consent forms and questionnaires were translated into isiXhosa and Afrikaans (the two most spoken languages in the Western Cape, apart from English), using UCT translation services. Verbal consent was obtained and

recorded on the REDCap database. Interviews were conducted in the participants preferred language with assistance from translators or nursing staff on the wards. Participants were interviewed in private cubicles or office rooms to protect privacy. Nursing staff and doctors were briefed about the study prior to the start of the data collection.

Data were de-identified. Participants were asked their permission to obtain their financial information from the hospital finance department in order to factor in medical bills attributed to the surgical admission. Participants were also asked permission to obtain their contact details so that follow-up calls could be made to enquire about their long-term OOP expenditure and their ability to cope with the expenditure post-discharge. Participants were given the option to refuse to answer questions and to withdraw from the study at any point.

Permission was also obtained to use participant spatial data (addresses and postal codes) for geospatial analysis.

SECTION 4.6 VARIABLES AND DEFINITIONS

Three universally-accepted definitions for CHE were used from existing literature. While two of the three CHE definitions utilize annual income, our study employed household expenditure as a proxy for annual income:

1) OOP payments for direct costs associated with surgical care that were 40% or more of annual non-food expenditure (CHE40),

2) OOP payments for direct costs associated with surgical care that were 25% or more of annual total household expenditure (HHE) (CHE25),

3) OOP payments for direct costs associated with surgical care that were 10% or more of annual total HHE (CHE10).

Expenditure is a commonly used measure in calculating financial catastrophe because it is considered a more reliable measure compared to income, which is subject to acute and dramatic changes over time (21). Expenditure is often a better indication of a household's capacity to spend, often with the understanding that a household will spend within its means. Subsistence expenditure is regarded a necessity and impacts substantially on a household's capacity to pay, particularly among the poorest quintile of the population, and was therefore accounted for in the CHE40 definition.

Table 1 outlines the continuous and categorical variables used.

1. H0: patients qualifying for full subsidization (pensioners, anyone on a social grant, or formally unemployed).
2. H1: patients qualifying for partial subsidization (annual household income <R100,000)
3. H2: patients qualifying for partial subsidization (annual household income <R200,000)
4. H3: all services are costed at full price (annual income >R200,000)

Table 1: List of Variables

Variable name	**Variable type**	**Variable definition**
Age	Continuous	Age of the participant in years
Sex	Categorical	Male or Female
Health insurance	Categorical	Yes or No
Level of education	Categorical	No education Some primary school, Completed primary school Some secondary school Completed secondary school Completed a diploma Completed a degree
Employment status	Categorical	Unemployed Housewife Scholar Casual Contract/temporary

		Full-time employed
SA citizenship	Categorical	Yes or No
Dwelling type	Categorical	Informal or formal
Water source	Categorical	Improved drinking water source or not
Electricity	Categorical	Yes or No
HHE	Continuous	Participants total annual HHE (in rand)
Per capita HHE	Continuous	Total HHE divided by the number of household members
OOP payments	Continuous	Total OOP payments for direct medical, direct non-medical, and indirect costs (in rand)
OOP/HHE	Continuous	Proportion of HHE attributed to total OOP
CHE	Categorical	CHE10 (Yes/No) CHE25 (Yes/No) CHE40 (Yes/No)

SECTION 4.7 DATA CAPTURING

All information was captured directly on the REDCap mobile database, which was password-protected. All 263 (100%) participants gave permission for their medical bills to be obtained from the NSH finance department, and 227 (82.9%) participants agreed to be contacted after one-month for a follow-up regarding extra healthcare expenses related to the surgical condition after discharge, and to find out how they were coping with the financial burden, if any, of the surgical condition and admission. Permission was given by the hospital Chief Executive Officer to obtain the medical bills for the surgical admission during which the participant was interviewed from the hospital finance department. Information regarding previous or current outstanding bills were difficult to obtain because the information was not linked to any specific admission.

SECTION 4.8 DATA ANALYSIS

Data collated on REDCap were exported into Stata 15 SE (College Station, TX) for analysis. The Shapiro Wilk test was performed to test the normality of data. Descriptive analyses of participants' demographic characteristics and socio-economic circumstances were performed and proportions or percentages reported for categorical variables. Medians (with interquartile ranges (IQR)) were reported for continuous variables, such as age, as the data were non-normally distributed. A p-value of <0.05 was considered to be statistically significant.

Five outcomes were measured:

1) OOP;
2) OOP as a share of total HHE;
3) CHE10: OOP payments for direct medical and non-medical costs of surgical admissions greater than or equal to 10% of annual household total expenditure.
4) CHE25: OOP payments for direct medical and non-medical costs of surgical admissions greater than or equal to 25% of annual household total expenditure; and
5) CHE40: OOP payments for direct medical and non-medical costs of surgical admissions greater than or equal to 40% of annual household non-food expenditure (i.e. CTP);

OOP payments for various healthcare costs were categorised into direct medical, direct non-medical, and indirect (according to the literature), and were reported using measures of association: medians (with IQR) were reported due to outliers and non-normally distributed data.

Ordinary least squares (OLS) multivariable linear regression was performed to determine the relationship between OOP healthcare expenditure and other independent continuous variables, such as distance from facility and length of stay. OLS multivariable linear regression was also used to determine the relationship between OOP and other categorical variables (age, sex, department to which participant was admitted). A univariate analysis was

conducted first, all variables with a $p<0.2$ were included in the multivariable analysis. A p-value<0.05 was considered statistically significant in the multivariable analysis.

It is important to note that CHE was only calculated for the surgical admission during which the participant underwent an operation and was interviewed in the post-operative period, prior to discharge; in keeping with previous literature (2, 4, 55). It was not possible to determine the risk factors associated with CHE, as the proportion of the participants experiencing CHE was low (less than five outcomes), therefore, risk factors for OOP were assessed instead.

Impoverishment was calculated by subtracting the OOP from the household's monthly income and determining the proportion of individuals who fell below the upper-bound poverty line (R1227 per month) following OOP payments for the surgical admission. South Africa has a high baseline poverty rate. The upper-bound poverty line reflects poverty, while the lower-bound poverty line often is akin to the definition of extreme poverty. The upper-bound poverty line was therefore used to ensure that the proportion of impoverished and marginalized households were considered.

A Pearson's correlation coefficient was calculated to assess the relationship between CHE and impoverishment.

Two open-ended questions were included in the questionnaire and were analysed quantitatively by reporting the number of participants who reported similar themes or words. Participants responses were categorised according to common themes and tabulated or reported in-text to justify specific quantitative findings.

SECTION 4.9 GEOSPATIAL ANALYSIS

Geospatial analysis was performed using ArcGIS to determine the spatial association between participant domicile and the percentage of HHE attributed to OOP payments for surgical care. The analysis was performed on a password-protected computer and data were de-identified for the geospatial analysis. Shapefiles of informal settlements and official

suburbs in Cape Town were downloaded from the City of Cape Town Official Datasets website (84). There is a lack of freely available shapefiles representing geospatial data from the Western Cape. A map of the West Coast suburbs was mapped using online tools and added to the existing City of Cape Town map to form a map of the greater Cape Town area.

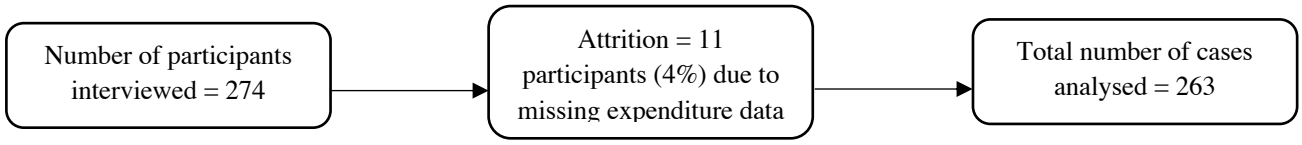
Chapter 5- Results of the study:

SECTION 5.1 ATTRITION RATE

Over the one-month period, 274 participants agreed to be interviewed. However, 11 participants refused to answer questions relating to their HHE and OOP expenses for healthcare. As a result, these participants were excluded from the study, resulting in an attrition rate of 4%. The results presented in this study are representative of the remaining 263 participants.

The 11 participants who refused to report their expenditure data were random. There were no defining characteristics of the group lost to follow-up.

Figure 3: Participants and attrition rate



Of the 263 participants, 182 were female (69.2%), and the median age was 24 (IQR 26-48). The majority of participants were South African citizens (n=221, 84.0%), and more than half lived above the upper-bound poverty line (n=133, 50.6%). Only 14 participants (5.3%) had private health insurance, and most were utilising the public health sector because their insurance was exhausted or would not cover the surgical procedure. Of the participants with health insurance, none were reimbursed for their OOP expenditure on healthcare. Most of the participants were classified as H0 or H1 according to the South African UPFS (n=222, 91.3%), meaning that, at the minimum, they were charged an admission fee, but most were not billed.

One hundred and ninety-four participants (73.8%) lived in formal housing, four participants (1.5%) were homeless, and 27 participants (10.3%) did not have access to an improved toilet facility. All participants had access to clean piped water, and 14 participants (5.3%) did not have access to electricity. Most participants (n=197, 74.9%) did not own a vehicle and utilised public transport. One-hundred-and-five participants (39.9%) were unemployed.

While only 24 participants (9.1%) entered tertiary education, only two participants (0.8%) had no formal schooling. Table 2 outlines the demographic characteristics of the study population.

SECTION 5.2 COMMENT ON THE NORMALITY OF THE DATA

Total OOP expenditure data were significantly negatively skewed and there was a non-normal distribution. A Shapiro Wilk test was performed to demonstrate the non-normality of the data ($p<0.001$).

Table 2: Demographic characteristics of persons undergoing surgical care at New Somerset Hospital, Cape Town, South Africa

Total number of participants	n = 263
Age (continuous variable)	Median = 34 (IQR 26 – 48)
Sex	
Male	81 (30.8%)
Female	182 (69.2%)
Uniform patient fee schedule classification	
H0	20 (7.6%)
H1	220 (83.7%)
H2	21 (8.0%)
H3	2 (0.8%)
SA citizenship	
Yes	221 (84.0%)
No	41 (15.6%)
Do not know	1 (0.4%)

Poverty (number of participants who live below national poverty lines based on monthly income per person in rands)	
Food poverty line (Extreme poverty line)	65 (24.7%)
Lower-bound poverty line	103 (39.2%)
Upper-bound poverty line	130 (49.4%)
Private health insurance	
Yes	14 (5.3%)
No	248 (94.3%)
Not sure	1 (0.4%)
Socioeconomic factors	
Type of dwelling	
Formal dwelling	194 (73.8%)
Informal dwelling	65 (24.7%)
Homeless	4 (1.5%)
Toilet facility	
Improved toilet facility	245 (93.2%)
Unimproved toilet facility	18 (6.8%)
Access to amenities	
Improved drinking water source	263 (100.0%)
Unsafe drinking water source	0 (0.0%)
Electricity	
Yes	249 (94.7%)
No	14 (5.3%)

Personal vehicle ownership	
Yes	66 (25.1%)
No	197 (74.9%)
Employment	
Unemployed	105 (39.9%)
Employed (full-time, part-time, self-employed, casual)	158 (34.2%)
Student/learner	20 (7.6%)
Pensioner	36 (13.7%)
Housewife	7 (2.7%)
Disability grant	5 (1.9%)
Level of education	
Completed/some secondary school	198 (75.3%)
Completed/some primary school	36 (13.7%)
Completed diploma	18 (6.8%)
Complete degree	6 (2.3%)
Do not know	3 (1.1%)
No education	2 (0.8%)

*Food poverty line is less than R561 per person per month

*Lower bound poverty line is less than R810 per person per month

*Upper bound poverty line is less than R1227 per person per month

(Based on the 2019 South African National Poverty Lines)(7)

The most common procedures were general surgery (n=90, 34.2%), followed by obstetric (n=62, 23.6%) orthopaedic (n=57, 21.7%), and gynaecologic (n=54, 20.5%). See Table 3. Two thirds of participants (n=171, 65.0%) underwent an emergency procedure. There were

10 oncologic procedures (3.8%), and one-fifth underwent a procedure for trauma (n=50, 19.0%).

Table 3: Types of surgical conditions at New Somerset Hospital in Cape Town, South Africa

Department	
General Surgery (incl. ENT and Urology)	90 (34.2%)
Obstetrics	62 (23.6%)
Orthopaedics	57 (21.7%)
Gynaecology	54 (20.5%)
Procedure type	
Emergency	171 (65.0%)
Elective	92 (35.0%)
Condition	
Cancer	10 (3.8%)
Trauma	50 (19.0%)
Other (other general surgery, obstetric, gynecological, or orthopaedic conditions not caused by trauma or cancer)	203 (77.2%)

Of all the participants interviewed, 130 (49.4%) had previously sought care for the same surgical condition (either as an inpatient or outpatient) (see Table 4). Of the 130 participants, 68 (25.9%) incurred OOP payments of varying amounts (nominal range excluding the zeros is R30 – R3500; median = R0, IQR R0 – R40) for the surgical condition 12 months prior to the surgical admission.

Table 4: Previous health-seeking behaviour of persons with surgical conditions admitted at New Somerset Hospital

Previous OPD visits (outpatient) in the 12-month period prior to surgical admission	
Yes	119 (54.6%)
Median number of visits per annum	0 (0-1)
No	143 (45.4%)
Previous surgical admissions (inpatient) in the 12-month period prior to surgical admission	38 (14.5%)
Yes	
Median number of admissions per annum	0 (0-0)
No	225 (85.6%)

SECTION 5.3 OBJECTIVE 1: TO DETERMINE THE MAIN CONTRIBUTING COSTS TO OOP PAYMENTS

One-hundred-and-fifty-nine participants (56.7%) incurred a medical bill, the rest (105, 40.5%) were not charged. Medical bills accounted for 30.7% of total OOP payments for surgical admission. Of the 156 participants (59.5%) who incurred transport costs, transport accounted for 28.6% of total OOP payments, see Table 5. Of the participants that received a medical bill, the average cost was R293.07 (SD +- R1577.76), see Table 6.

Compared to the results for the surgical condition which took into consideration OOP over a 12-month period, 241 participants (91.3%) incurred OOP expenditure for their surgical admission, ranging from R10 to R22,174 (median R200, IQR R90 – R476).

Of the total OOP payments incurred by all participants for the surgical admission, 41.0% of the OOP was due to the medical bills, 20.3% of the OOP was due to transport, 25.6% was due to the loss of income, and 10.7% was due to food. All other OOP costs were negligible.

Of the OOP payments incurred by participants, the median percentage due to medical bills was 20.5% (0% - 69.2%), the median percentage due to transport was 16.0% (0% – 61.7%), and the median percentage due food was 0% (0% - 31.3%)

Table 5: Direct medical and non-medical as a share of total OOP healthcare expenditure

Medical bill	
Number of participants who were not billed	104 (40.5%)
Number of participants who were billed by the hospital	159 (56.7%)
The share (%) of medical bills in total OOP spending (mean)	30.7% (SD +-37.6%)
The share (%) of medical bills in total OOP spending (median)	10.2% (IQR 0% - 64.3%)
Transport	
Number of participants who incurred transport costs	156 (59.5%)
The share (%) of transport in total OOP spending (mean)	28.6% (SD+-35.8%)
The share (%) of transport in total OOP spending (median)	8.2% (IQR 0% - 55.6%)

Table 6: OOP costs incurred as a result of the surgical admission

Direct costs	
Medical	
Medical bill	
Mean	R293.07 (SD +- 1577.76)

Median	R90 (IQR R0 – R90)
Non-medical costs	
Transport	
Mean	R143.78 (SD +- R479.43)
Median	R30 (IQR R0 – R150)
Food	
Mean	R74.92 (SD +-R221.36)
Median	R0 (R0 – R80)
Indirect costs	
Loss of income	26 out of 158 participants (16.5%)
Mean	R178.40 (SD +- R1025.43)
Loss of property (due to theft at the hospital)	No participants experienced the loss of property

Of the 263 participants, only 130 reported previously seeking healthcare for the same surgical condition as the surgical admission. A total of 68 out of the 130 participants (25.9%) incurred OOP payments for their surgical condition (prior to the surgical admission), which included fees for private doctors, tests and investigations, and medication; these costs range between R30 – R3500 (mean R174, SD R486.71). Table 7 illustrates the OOP payments for surgical care prior to the reference surgical admission and does not include the surgical admission during which the participant underwent a surgical procedure.

Table 7: OOP costs for surgical condition

Direct costs	
Private doctors' fees	
Number of participants that accessed private care	34 (12.9%)
Nominal range	R180 – R3000
Tests and investigations	
Number of participants	6 (2.3%)
Nominal Range	R90 - R2000
Medication	
Number of participants	21 (8%)
Nominal range	R40 – R1720

SECTION 5.4 OBJECTIVE 2: TO ASSESS STRATEGIES USED TO FINANCE OOP PAYMENTS FOR SURGICAL CARE

OOP payments were financed by various methods (see Table 8). These methods were not mutually exclusive, participants had the option to chose more than one method of financing. With respect to borrowing money or receiving financial assistance as a gift, participants were also allowed to state more than one type of OOP payment they received finance for. The majority of participants financed their OOP payments through savings (n=152, 57.8%), of which 36 participants (23.7%) used their entire savings. Participants reported their savings to be small amounts of money they had saved up. Thirty-eight participants (14.5%) had to borrow money to finance OOP payments, sixty-one participants (23.2%) received financial assistance as a gift either in the form of money (n=54, 20.5%), or transport or food (n=12, 4.6%). No participants had to sell assets. Two participants (0.8%) had to reduce spending on

necessities such as food. Thirty-two participants (26.9%) had to take on extra work to generate more income following the surgical admission.

Table 8: Methods by which OOP payments were financed

Method	N (%)
Savings	152 (57.8%)
Used entire savings	36 (23.7%)
Borrowed money	38 (14.5%)
Relative	13 (4.9%)
Friend	18 (6.8%)
Employer	1 (0.4%)
Bank	0 (0%)
Other money lender	8 (3.0%)
Received financial assistance as a gift	61 (23.2%)
Money	54 (20.5%)
Other (Transport/Food)	12 (4.6%)
Sold Assets	0 (0%)
Reduced spending on necessities such as food	2 (0.8%)
Participant or household member had to take on extra work to generate more income	32 (12.2%)

*These methods are not mutually exclusive; participants were allowed to select all the options that applied to their surgical admission

SECTION 5.5 OBJECTIVE 3: TO IDENTIFY RISK FACTORS ASSOCIATED WITH OOP EXPENDITURE

The associations with OOP payments and per capita HHE were assessed. The median number of household members per household was 3 (IQR 2-5).

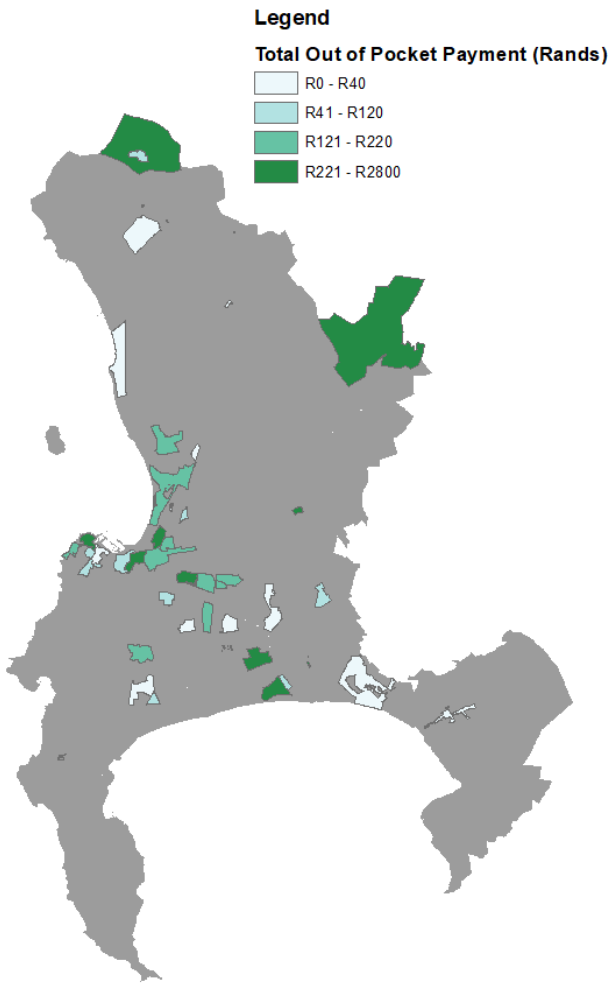
Table 8 shows the linear regression of OOP with other independent variables. There were four statistically significant risk factors for increased OOP: low per capita HHE, cancer, having health insurance, and the bill amount. Linear regression revealed that there was no correlation between the proportion of OOP payments and LOS or distance.

Table 8: Linear regression showing associations with OOP expenditure for the surgical admission

Independent variable	**Coefficient**	**p-value**	**Confidence interval**
Per capita HHE	0.1	0.02	0.0 – 0.2
Elective	-291.9	0.31	-861.3 – 277.5
LOS	50.3	0.06	-1.4 – 102.0
Distance	-5.8	0.11	-12.9 – 1.3
Department			
Obstetrics	-124.1	0.75	-635.-7 – 883.9
General Surgery	-72.3	0.84	-774.6 – 629.9
Orthopaedics	757.4	0.12	-193.4 – 1708.1
Gynaecology	(ref)		
Trauma	373.9	0.38	-461.0 – 1208.8
Cancer	2199.2	0.001	855.4 – 3543.1
Age	3.2	0.69	-12.5 – 19.0
Sex (female)	289.5	0.28	-240.2 – 819.26
Employment			
Formal employment	-226.8	0.42	-784.1 – 330.5
Informal employment	6.9	0.99	-1073.1 – 1086.9
	(ref)		

Unemployed			
Level of education			
Primary education	-885.2	0.35	-2738.1 – 967.6
Secondary education	-280.4	0.76	-2031.6 – 1470.9
Tertiary education	-247.2	0.80	-2156.8 – 1662.4
None	(ref)		
Insured (yes)	1701.2	0.002	638.1 – 2764.3
Medical bill amount	1.0	p<0.001	0.9 – 1.1
Total number of observations	246		

Figure 4: Total OOP expenditure for surgery amongst participants from various suburbs in the NSH drainage area



*The grey area in the in the diagram represents areas in Cape Town that had no data.

Figure 4 illustrates that there was no correlation between distance from NSH and out-of-pocket payments. Some regions furthest from NSH (marked with a black dot on the diagram) experienced OOP between R221 – R2800, however, there were equidistant regions that did not experience any OOP for their surgical admission.

SECTION 5.6 OBJECTIVE 4: TO DETERMINE THE PROPORTION OF SURGICAL PARTICIPANTS AT NSH THAT EXPERIENCE CHE AND IMPOVERISHMENT

CHE40 was 0.8% with two out of 263 participants spending 40% or more of their annual household non-food expenditure on their surgical admission. CHE25 was 1.1%. with three participants spending 25% or more of their total annual HHE on OOP payments for their surgical admission. CHE10 was 1.9% with five participants spending 10% or more of their total annual HHE on their surgical admission.

In addition to CHE, the percentage of annual HHE (both non-food and total) attributed to OOP payments was also analysed. The median proportion of annual household non-food expenditure attributed to OOP payments for the surgical admission was 0.8% (IQR 0.3% - 2.2%). The median proportion of total annual HHE attributed to total OOP payments for surgical admission was 0.5% (IQR 0.2% - 1.0%).

Twenty-four participants (9.1%) incurred no OOP expenditure for surgical admission. Two-hundred-and-fifty-one (95.4%) participants spent less than 10% of their non-food expenditure on their surgical admission, while 258 participants (98.1%) spent less than 10% of their annual total HHE.

Fifty participants (19.0%) experienced impoverishing health expenditure as a result of surgical admission. There is a statistically significant negative relationship between impoverishment and CHE (Pearson's correlation coefficient = -0.2, p=0.002).

SECTION 5.6 OBJECTIVE 5: UNDERSTANDING THE PERCEPTIONS OF OOP PAYMENTS FOR PARTICIPANTS ACCESSING SURGICAL CARE

Planning for surgical care:

Participants reported that they did not have to bear a significant financial burden if they were able to plan for their surgical admission. "I was able to plan for this admission, so I could save some money to come here." This was common among elective participants who reported that "I had to work extra hours last month because I knew I was coming to the hospital." Likewise, if participants were admitted for emergency surgical procedures, they

perceived the financial burden to be significant, “Money for health is not always available, it is difficult to plan for it.”

Non-medical costs:

While direct non-medical costs did not account for a significant proportion of OOP payments for surgical care, patients persistently reported that “transport is getting expensive and getting to the hospital is expensive”. Furthermore, although the geospatial analysis did not show a correlation between distance from facility and geographical location, patients who lived further away from the facility reported: “I do not have a lot of money, where I live is far, and we have to pay for our own transport.”

Opportunity costs were not commonly reported, with only 26 patients reporting a loss of income, “It has not been very expensive, I just lose a lot of money from being hospitalised.” This might be due to the high unemployment rate in our study population (approximately 40%).

Healthcare is perceived as a necessity (Principle of elasticity)

The principle of price elasticity of demand is evident in this study population with participants stating that they “needed this operation so I was willing to pay for it” and there were “no negative effects. It needed to be done.”

Very few participants experienced OOP payments for healthcare, and most participants reported that OOP expenditure was “not so expensive.” Participants also reported, “I have not had to pay anything yet,” and “this was not too bad because it was one admission.”

Elective surgical conditions:

When asked how the costs associated with the surgical admission had affected their livelihood, many participants who had an elective surgical procedure reported they were

"able to plan for this admission so the costs were not that great", and therefore there was "not much of an impact from the costs".

Emergency surgical conditions

Patients who underwent emergency surgical procedures reported that "it has been difficult to pay for other things in the house because of having to pay for transport", "we are going to fall behind now with our payments because I have been in hospital and cannot work". More importantly, patients reported not being able to plan financially for being sick. "Although we have not had to pay much, I did not plan to be sick, so we did not budget for this", "money for healthcare is not always available, it is difficult to plan for it."

Table 9: Perceptions of the financial impact of surgical admission at New Somerset Hospital, Cape Town, South Africa

	N (%)
Minimal	54 (20.5%)
Household managed easily	61 (23.2%)
Household copes, but with difficulty	74 (28.1%))
Burden from which the household is still recovering	40 (15.2%)
Household unable to cope and its survival is threatened	25 (9.5%)
Refused to answer	9 (3.4%)

Table 10: Contribution of the perceived financial burden to the stress of the surgical admission

	N (%)
Not at all	41 (15.6%)
A little bit	61 (23.2%)

Moderately	57 (21.7%)
Quite a bit	49 (18.6%)
Extremely	47 (17.9%)
Refused to answer	8 (4.0%)

Chapter 6 – Discussion

Section 6.1 Main findings

Our study showed that 95% of participants used less than 10% of their monthly expenditure for OOP payments with almost 10% of participants reporting no OOP payments. This suggests that the South African public healthcare system protects against CHE using a tiered user-fee coding system (UPFS) (20, 85). In our study, 80% of participants were charged less than R100 (the equivalent of $7), or nothing at all, and were relatively protected against CHE. This is consistent with previous literature that shows South Africa to have a near-zero CHE rate in 1995 (17). Nearly twenty percent of participants experienced new or worsening impoverishment as a result of OOP payments for the surgical admission.

This study identified, that although CHE was low, the majority (three-quarters) of participants incurred some OOP for the surgical admission and IHE was substantial with one in five participants experiencing new or worsening poverty as a result of OOP expenditure on the surgical admission. This further suggests that the financial burden of health care expenditure is shouldered by the country's poorest populations. This finding suggests that, while CHE is the most commonly reported measure of health care expenditure, measuring and reporting IHE is crucial in determining the effects on the most vulnerable populations. This finding also strengthens the argument for a National Health Insurance plan in South Africa, to protect against impoverishment.

In comparison to the 2018 World Bank Indicators on surgical CHE and IHE in South Africa, that reported CHE as 15% and 27%, respectively, this study found CHE and IHE to be lower (86, 87). This might be explained by the study population and site chosen for this study. NSH is a second-level public sector hospital that performs a large proportion of general surgical conditions, as opposed to more highly specialized conditions that might require more specialized and expensive surgical care, such as oncological surgical conditions or assisted reproductive therapy. Furthermore, the hospital is located centrally and easily accessible to most individuals in the catchment area. The World Bank estimate for CHE and the findings for CHE in our study are higher than the previously reported risk of 0.5 by Xu et al (4).

Although most medical bills were low, owing to protection conferred by the UPFS, the major drivers of OOP expenditure were medical bills, when they were incurred by individuals who were not protected by the UPFS, and transport costs. There could be several reasons for this low OOP payments expenditure on surgical care: 1) more than half of participants were not billed for direct medical costs which included the operation, investigations, and medication; 2) non-medical costs did not contribute significantly, as often inpatient food and transport to and from the hospital were provided by hospital transport vehicles, and 3) indirect medical costs were not significant contributors to OOP payments.

Although CHE was low, findings from our study suggest that South Africans might be at high risk for financial catastrophe, as even small payments make up a significant proportion of their capacity to pay. Arguably, even though healthcare is considered price inelastic, the more a household is forced to decrease spending on other basic needs, the less willing they will be to spend money on healthcare (88, 89). This could potentially negatively affect health-seeking behaviour.

In comparison to previous literature that showed user fees (direct medical costs) in the public sector accounted for up to 18% of total OOP expenditure on healthcare (81), our study found that user fees (direct medical costs) accounted for approximately 30% of total OOP expenditure. This should be considered alongside the fact that only 57% of participants actually incurred direct medical costs, suggesting that for those who were billed for the surgical admission, the bill amount made up a greater proportion of their total HHE when compared with previous studies (90, 91). Although our study focused specifically on surgical CHE, this finding could potentially highlight that South Africans are at increased risk for financial catastrophe as a result of direct medical costs if there is no health insurance plan to protect against it, strengthening the argument for the NHI.

In contrast to previous literature, there appeared to be no correlation between household income and share of HHE attributed to OOP payments. This highlights that even small increases in OOP payments can be disastrous for households, resulting in greater proportions

of their household income being used for healthcare payments, which will often force households to spend less on other items. This can be particularly devastating for poorer households, that already use their income to finance basic needs or subsistence (55). In these cases, it is likely the perceived severity of the problem that will dictate whether or not participants seek care.

Section 6.2 Risk factors for OOP payments

Our study highlighted four risk factors for OOP payments for healthcare expenditure: 1) low per capita HHE, 2) having cancer requiring surgical treatment, 3) having non-generous health insurance plan, and 4) high medical bill amounts. Surgical care for cancer is often highly specialised and associated with CHE in previous literature (92-94) and in our study, although CHE was not a common outcome, cancer was associated with increased OOP expenditure. Counterintuitively, having a non-generous health insurance plan was a risk factor for increased OOP amongst this study population as health insurance policies did not cover any of the patients who sought care in the public sector. Reasons for this include: 1) participants who were insured were on a health insurance plan that did not cover certain surgical procedures; 2) participants had only started paying for health insurance a few months prior to being admitted for an operation often participants require to be registered for one year before their health benefits and coverage apply, and 3) participants who failed to pay his/her health insurance premium or if they have used up all their healthcare benefits for the year were not covered by their insurers, also known as health insurance exhaustion.

Nearly half the participants had previously sought healthcare for the same surgical condition, incurring OOP costs for the inpatient or outpatient care received prior to the surgical admission. Interestingly, those with a longer course of illness did not necessarily have higher OOP expenditure.

The relationship between OOP expenditure and participant residential address (suburb) was assessed via a geospatial analysis, which illustrated a lack of a relationship between OOP expenditure and participant address. Participants who lived in rural suburbs, such as

Malmesbury Farms, incurred little OOP payments, while there were some rural suburbs where participants incurred higher OOP costs. The same applied to urban settings, where OOP costs varied greatly between suburbs. Although a geographic-weighted regression was not performed due to the small sample size and geographically dispersed population, there is likely no relationship between distance from facility and total OOP expenditure because most participants receive transport via a hospital participant transport vehicle.

There is also, interestingly, no association between OOP payment and length of stay. It was presumed that the greater the length of stay, the greater the risk of financial catastrophe. However, due to the low proportion of participants incurring CHE, it was not possible to quantify the risk of CHE for the length of stay.

Although non-medical costs have been found to contribute greatly in previous studies, our study found that these costs did not contribute greatly to the share of OOP payments (15, 69). A likely explanation is that there are relatively few OOP payments for participants in the Western Cape as transport is often provided to the furthest facilities, such as Vredenburg and Atlantis, and food is also often provided at NSH.

In this study, participants reported that when they did not pay for previous healthcare services in the public sector, they were not prohibited from accessing further healthcare services. Post-apartheid, healthcare reform was emphasized to improve access to healthcare for all South African citizens, especially the poorest and most marginalised (95). In an attempt to realise this, the South African government expanded healthcare facilities and abolished user fees for primary healthcare, establishing the UPFS (95). Moreover, there has been a relative decline in access of public health sector services (96), suggesting that the relative lack of user fees and direct medical costs, confirmed in our study, coupled with participant perceptions that they "do not have to pay much" does not necessarily result in increased uptake of healthcare (96). This is in stark contrast to other LMICs where the abolishment of user fees has resulted in an increased uptake in healthcare (97, 98). Medical costs are relatively low yet healthcare in South Africa remains inequitable, polarised, and inaccessible (47, 48, 99), which suggests that user fees are not driving the inequities in the public healthcare sector. There are many other barriers to seeking, reaching, receiving, and being retained in care in South Africa.

While not specifically related to surgical care, reported patient perceptions of seeking healthcare in the South African public sector are often negative. Patients have previously reported lack of education resulting in poor health-seeking behaviour, and lack of health care provider competence resulting in barriers to receiving care, leading to mistrust in the health care system (100, 101). Furthermore, resource limitations and long waiting lists are often barriers to receiving care. Lack of referral pathways, mismatch between resources and providers at facilities, and lack of healthcare provider training and support have all been identified as barriers to accessing surgical care in South Africa (102). This evidence speaks to the notion that healthcare reform and health financing policy cannot be undertaken in isolation. Focusing exclusively on affordability will not necessarily improve access to healthcare for the most vulnerable populations (103-105). Further research on barriers to accessing surgical care in South Africa is needed.

Section 6.3 Financing of OOP payments

Although CHE was low, many participants experienced financial hardship to finance their OOP expenses for healthcare. Participants were vulnerable to using up all their savings to pay for the OOP payments costs they did incur. Historically, South Africans have not been known to save for healthcare expenses (106, 107). This suggests that South Africans seeking healthcare in the public sector would be vulnerable to any direct or indirect cost increases even if the increase was not measured.

One-quarter of participants reported using up all their savings to finance their surgical admission expenses. The only savings they had accumulated was cash that they kept on-hand for unexpected expenses, and as a result were used up quite quickly, in our study, this usually amounted to no more than R200. Of those that experienced impoverishment, about 30% used up all their savings ($p=0.02$). This was common among participants requiring an emergency admission, reporting: “although we have not had to pay much, I did not plan to be sick, so we did not budget for this.” Few participants had to borrow money, but when they did, this would have to be paid back with interest. One-quarter of households had to take on extra work to generate extra income following the surgical admission, while some worked extra hours in preparation for a surgical admission, “I had to work extra hours last month because I

knew I was coming to the hospital." It is not possible to say, from this study, whether being able to prepare for a surgical admission reduces CHE.

Responses varied with regard to the impact on the likelihood of having to pay OOP for surgical procedures. More than 70 percent of participants felt their households were coping with the financial burden of the surgical admission, or that there was minimal, if any, the financial burden associated with their surgical admission.

Financial catastrophe as a result of healthcare systems that do not protect their users against OOP expenditure has long been ignored on the public health agenda. Despite low CHE, OOP payments were experienced by over 90% of participants. With the rollout of NHI in South Africa, it is crucially important to understand all aspects of healthcare financing and to support systems that will limit OOP payments for healthcare. In particular, OOP payments attributed to surgical conditions are not well-enough described in the South African setting. The few studies that exist describing CHE for surgical care, along with this study, are not enough to inform policy around financial risk associated with surgical care in South Africa. In addition, given the large inequities in access to surgical care in South Africa, other factors also need to be investigated.

Section 6.4 Limitations and strengths

This study had limitations. This was a single-institution study, and the results may not apply to other South African hospitals. In this study, 1) the majority of participants were classified in the lowest two brackets according to the UPFS which suggests that they were the lower income levels, and likely poorer populations, which may not truly be representative of a South African population accessing public sector services; and 2) The hospital is also located in an urban area and CHE might differ for persons from rural areas who seek surgical care at facilities that might be farther from home, and resultantly, transport more expensive. In addition, surgical oncology conditions, which might incur higher CHE, were rarely treated at NSH, a second-level hospital. Third-level hospitals that care for these conditions, as well as other complex surgical conditions requiring longer hospital stays, might report higher CHE.

Participants in this study were public sector surgical patients, and we did not report on CHE or OOP payments for persons seeking surgical care in the private sector. Substantial OOP payments for healthcare expenditure have been reported by persons with private health insurance, as a result of co-payments and services not covered by the insurance (81). Further studies for private surgical participants and their risk of CHE are needed.

Despite the limitations, our study had several strengths. To our knowledge, this is the first study on CHE in South Africa in the public sector covering a range of surgical conditions. Furthermore, household income and expenditure data and OOP healthcare expenditure data were reported by individual participants and not extrapolated from national household surveys.

Our study has also offered granularity around non-medical and indirect costs. Transport costs were the greatest OOP expense incurred by almost 60% of the population and attributed to 29% of the total OOP payments. This was expected, as three-quarter of participants did not have a vehicle. Food and accommodation accounted for negligible OOP expenditure. Indirect (opportunity) costs, such as loss of income and loss of property, were also not important contributors to OOP payments. Sixty-five percent of participants were either unemployed or on a social grant. Of the 35% who were working, only 26 (16.46%) of the 158 employed participants experienced a loss of income. These costs, however, did not contribute significantly towards OOP expenditure.

Section 6.5 Recommendations

The public healthcare sector in South Africa is already utilising highly subsidised or free hospital services to protect against CHE and the UPFS should be strengthened as this has helped to reduce CHE. In addition to UPFS, the major drivers of OOP have been identified as medical bills and transport costs and should be addressed in future policy to reduce the burden of OOP substantially. In our study, the provision of transport through patient transport

services contributed to a reduction in OOP, therefore providing patient transport should continue to be provided and remain a priority in reducing OOP for surgical care.

Twenty percent of the population uses private sector healthcare and more studies are needed to identify risk for CHE and impoverishing expenditure is higher in this group. In addition, further research should be performed to determine whether certain at-risk surgical groups, such as oncological surgery and sub-specialised surgery, experience CHE. These studies will need to be conducted at more highly specialised hospitals. This study should also be repeated in a rural areas to determine whether CHE is a barrier to accessing surgical care in these settings. Other provinces should also conduct this study, as inequities in accessing healthcare exist provincially, too.

While this study did not explore other barriers to surgical care, other potential barriers to care could be acceptability and availability of healthcare services in South Africa and would be important to consider by NHI policymakers. More research in this aspect is required.

Section 6.6 Conclusion

Surgical CHE at NSH, an urban second-level hospital in the Western Cape province of South Africa is low. This is in keeping with previous literature on non-surgical conditions (4, 17). Little is known about surgical CHE worldwide, however, in contrast to CHE for non-surgical conditions in other LMICs worldwide,

CHE in South Africa is low, and the reasons for variation should be explored in further studies. While CHE was low, most patients experienced some form of OOP for their surgical care, and the main drivers of this OOP were the medical bills and transport costs. The abolishment of user fees and the UPFS likely protects against the direct medical costs of surgical care. Furthermore, non-medical costs did not appear to be an important contributing factor to OOP payments in this study, likely due to the provision of hospital transport.

Impoverishment was also not common amongst participants who had to finance their surgical admission OOP, however, many participants who used up all their savings to finance the surgical admission were impoverished.

It appears that there is relative protection against CHE in South Africa and the reasons for this should be explored in future studies to inform further policy to protect against financial catastrophe and impoverishment. In addition, despite this, surgical care is still inaccessible to many part of the South African population and further research into other barriers to care are needed.

References

1. Li Y, Wu Q, Xu L, Legge D, Hao Y, Gao L, et al. Factors affecting catastrophic health expenditure and impoverishment from medical expenses in China: policy implications of universal health insurance. J Bulletin of the World Health Organization. 2012;90:664-71.
2. Dyer SJ, Sherwood K, McIntyre D, Ataguba JE. Catastrophic payment for assisted reproduction techniques with conventional ovarian stimulation in the public health sector of South Africa: frequency and coping strategies. J Human Reproduction. 2013;28(10):2755-64.
3. Xu K, Evans DB, Carrin G, Aguilar-Rivera AM, Musgrove P, Evans T. Protecting households from catastrophic health spending. Health affairs. 2007;26(4):972-83.
4. Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJ. Household catastrophic health expenditure: a multicountry analysis. Lancet (London, England). 2003;362(9378):111-7.
5. Salud OMdl, Murray C, Evans DJHSPA. Household health system contributions and capacity to pay: definitional, empirical, and technical challenges. 2003.
6. Chen J. Poverty 2019 [Available from: https://www.investopedia.com/terms/p/poverty.asp.
7. Africa SS. National Poverty Lines 2019 2019 [Available from: http://www.statssa.gov.za/publications/P03101/P031012019.pdf.
8. Bondarenko P. Gross Domestic Product: Encylopaedia Britannica; 2019 [Available from: https://www.britannica.com/topic/gross-domestic-product.
9. Kenton W. Price Elasticity of Demand 2018 [Available from: https://www.investopedia.com/terms/p/priceelasticity.asp.
10. Bickler S, Ozgediz D, Gosselin R, Weiser T, Spiegel D, Hsia R, et al. Key concepts for estimating the burden of surgical conditions and the unmet need for surgical care. World journal of surgery. 2010;34(3):374-80.
11. Reddy CL, Makasa EM, Biccard B, Smith M, Steyn E, Fieggen G, et al. Surgery as a component of universal healthcare: Where is South Africa? South African Medical Journal. 2019;109(9):624-5.
12. Organization WH. Out-of-pocket payments, user fees and catastrophic expenditure [Available from: https://www.who.int/health_financing/topics/financial-protection/out-of-pocket-payments/en/.
13. Organization WH. World Health Assembly resolution 68.15: strengthening emergency and essential surgical care and anaesthesia as a component of universal health coverage. Sixty-Eighth World Health Assembly; 2015.
14. Wilson IH, Yamey G, Yip W, al e. Global Surgery 2030. Lancet (London, England). 2015;386:569-624.
15. Meara JG, Leather AJ, Hagander L, Alkire BC, Alonso N, Ameh EA, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. The Lancet. 2015;386(9993):569-624.
16. Harris B, Goudge J, Ataguba JE, McIntyre D, Nxumalo N, Jikwana S, et al. Inequities in access to health care in South Africa. Journal of public health policy. 2011;32(1):S102-S23.
17. Xu K, Evans DB, Carrin G, Aguilar-Rivera AM, Musgrove P, Evans T. Protecting households from catastrophic health spending. J Health affairs. 2007;26(4):972-83.

18. O'donnell O, Van Doorslaer E, Wagstaff A, Lindelow M. Analyzing health equity using household survey data: a guide to techniques and their implementation: The World Bank; 2007.
19. Uniform Patient Fee Schedule for Paying Patients Attending Public Hospitals: User guide 2015, (2015).
20. Walls HL, Vearey J, Modisenyane M, Chetty-Makkan CM, Charalambous S, Smith RD, et al. Understanding healthcare and population mobility in southern Africa: The case of South Africa. 2016;106(1):14-5.
21. Murray CJ, Xu K, Klavus J, Kawabata K, Hanvoravongchai P, Zeramdini R, et al. Assessing the distribution of household financial contributions to the health system: concepts and empirical application. 2003;12.
22. Pediatrics AAoPJ. Health care financing for the child with catastrophic costs. 1987;80(5):752-7.
23. Wyszewianski L. Financially catastrophic and high-cost cases: definitions, distinctions, and their implications for policy formulation. Inquiry. 1986:382-94.
24. Prescott N, Pradhan M, editors. Coping with catastrophic health shocks. Proceedings of the Conference on Social Protection and Poverty; 1999.
25. Wagstaff A, Doorslaer EvJHe. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993–1998. 2003;12(11):921-33.
26. Ranson MKJBotWHO. Reduction of catastrophic health care expenditures by a community-based health insurance scheme in Gujarat, India: current experiences and challenges. 2002;80:613-21.
27. Kawabata K, Xu K, Carrin G. Preventing impoverishment through protection against catastrophic health expenditure. SciELO Public Health; 2002.
28. Deaton A, Muellbauer J. Economics and consumer behavior: Cambridge university press; 1980.
29. Boerma T, Eozenou P, Evans D, Evans T, Kieny M-P, Wagstaff A. Monitoring progress towards universal health coverage at country and global levels. PLoS medicine. 2014;11(9):e1001731.
30. Shrime MG, Dare AJ, Alkire BC, O'Neill K, Meara JGJTLGh. Catastrophic expenditure to pay for surgery worldwide: a modelling study. 2015;3:S38-S44.
31. Ataguba JE-OJHE, Policy, Law. Reassessing catastrophic health-care payments with a Nigerian case study. 2012;7(3):309-26.
32. Wagstaff A, Flores G, Hsu J, Smitz M-F, Chepynoga K, Buisman LR, et al. Progress on catastrophic health spending in 133 countries: a retrospective observational study. The Lancet Global Health. 2018;6(2):e169-e79.
33. Organization WH. The world health report 2000: health systems: improving performance: World Health Organization; 2000.
34. Wagstaff AJBotwho. Poverty and health sector inequalities. 2002;80:97-105.
35. Ataguba JE, McIntyre D. Paying for and receiving benefits from health services in South Africa: is the health system equitable? Health Policy and Planning. 2012;27(suppl_1):i35-i45.
36. Shrime MG, Verguet S, Johansson KA, Desalegn D, Jamison DT, Kruk ME. Task-sharing or public finance for the expansion of surgical access in rural Ethiopia: an extended cost-effectiveness analysis. Health Policy and Planning. 2015;31(6):706-16.

37. Groen RS, Sriram VM, Kamara TB, Kushner AL, Blok L. Individual and community perceptions of surgical care in Sierra Leone. J Tropical Medicine International Health. 2014;19(1):107-16.
38. Hang HM, Byass P. Difficulties in getting treatment for injuries in rural Vietnam. J Public Health. 2009;123(1):58-65.
39. Leighton C. 22 Policy Questions about Health Care Financing in Africa 1995 [2005]. Available from: http://www. dec. org/pdf_docs/PNABW870. pdf,.
40. Witter S, Khalid Mousa K, Abdel-Rahman ME, Hussein Al-Amin R, Saed M. Removal of user fees for caesareans and under-fives in northern Sudan: a review of policy implementation and effectiveness. The International journal of health planning management. 2013;28(1):e95-e120.
41. Groen RS, Kamara TB, Nwomeh BC, Daoh KS, Kushner AL. Free health care for under 5 year olds increases access to surgical care in Sierra Leone: an analysis of case load and patient characteristics. World journal of surgery. 2013;37(6):1216-9.
42. Zhang XJ, Liang YB, Liu YP, Jhanji V, Musch DC, Peng Y, et al. Implementation of a free cataract surgery program in rural China: a community-based randomized interventional study. 2013;120(2):260-5.
43. Gilson L. The lessons of user fee experience in Africa. J Health policy planning. 1997;12(3):273-85.
44. McPake B, Hanson K, Mills A. Community financing of health care in Africa: an evaluation of the Bamako initiative. Social science & medicine. 1993;36(11):1383-95.
45. Ridde V. Fees-for-services, cost recovery, and equity in a district of Burkina Faso operating the Bamako Initiative. Bulletin of the World Health Organization. 2003;81:532-8.
46. UNICEF. The Bamako Initiative 2000 [Available from: https://www.unicef.org/sowc08/docs/sowc08_panel_2_5.pdf.
47. Coovadia H, Jewkes R, Barron P, Sanders D, McIntyre D. The health and health system of South Africa: historical roots of current public health challenges. Lancet (London, England). 2009;374(9692):817-34.
48. McIntyre D, Gilson L. Putting equity in health back onto the social policy agenda: experience from South Africa. J Social Science Medicine. 2002;54(11):1637-56.
49. Farmer PE, Nutt CT, Wagner CM, Sekabaraga C, Nuthulaganti T, Weigel JL, et al. Reduced premature mortality in Rwanda: lessons from success. British Medical Journal. 2013;346:f65.
50. Boes S, Gerfin M. Does full insurance increase the demand for health care? Health economics. 2016;25(11):1483-96.
51. Sahn DE, Younger SD, Genicot GJOBoE, Statistics. The demand for health care services in rural Tanzania. 2003;65(2):241-60.
52. Ringel JS, Hosek SD, Vollaard BA, Mahnovski S. The elasticity of demand for health care. A review of the literature and its application to the military health system. RAND NATIONAL DEFENSE RESEARCH INST SANTA MONICA CA; 2002.
53. Merlis M. Family out-of-pocket spending for health services: a continuing source of financial insecurity: Commonwealth Fund New York; 2002.
54. Wyszewianski L. Families with catastrophic health care expenditures. J Health services research. 1986;21(5):617.
55. Ataguba JE-O. Reassessing catastrophic health-care payments with a Nigerian case study. J Health Economics, Policy, Law. 2012;7(3):309-26.

56. Su TT, Kouyaté B, Flessa SJBotWHO. Catastrophic household expenditure for health care in a low-income society: a study from Nouna District, Burkina Faso. 2006;84:21-7.
57. Hamid SA, Ahsan SM, Begum A. Disease-specific impoverishment impact of out-of-pocket payments for health care: evidence from rural Bangladesh. J Applied health economics, Health Policy and Planning. 2014;12(4):421-33.
58. Meara JG, Greenberg SL. The Lancet Commission on Global Surgery Global surgery 2030: evidence and solutions for achieving health, welfare and economic development. Surgery. 2015;157(5):834-5.
59. Raykar NP, Yorlets RR, Liu C, Greenberg SL, Kotagal M, Goldman R, et al. A qualitative study exploring contextual challenges to surgical care provision in 21 LMICs. 2015;385:S15.
60. Jan S, Kimman M, Peters S, Woodward M. Socioeconomic consequences of surgery for cancer in South-East Asia: results from the ACTION Study. Surgery. 2015.
61. Ensor T, Ronoh J. Effective financing of maternal health services: a review of the literature. J Health policy. 2005;75(1):49-58.
62. McIntyre D, editor Learning from experience: health care financing in low-and middle-income countries2007: Global forum for health research Geneva.
63. Yates R. Universal health care and the removal of user fees. Lancet (London, England). 2009;373(9680):2078-81.
64. Prinja S, Jagnoor J, Sharma D, Aggarwal S, Katoch S, Lakshmi P, et al. Out-of-pocket expenditure and catastrophic health expenditure for hospitalization due to injuries in public sector hospitals in North India. PLoS one. 2019;14(11):e0224721.
65. Bijlmakers L, Wientjes M, Mwapasa G, Cornelissen D, Borgstein E, Broekhuizen H, et al. Out-of-pocket payments and catastrophic household expenditure to access essential surgery in Malawi - A cross-sectional patient survey. Annals of medicine and surgery (2012). 2019;43:85-90.
66. Yap A, Cheung M, Kakembo N, Kisa P, Muzira A, Sekabira J, et al. From Procedure to Poverty: Out-of-Pocket and Catastrophic Expenditure for Pediatric Surgery in Uganda. The Journal of surgical research. 2018;232:484-91.
67. Anderson GA, Ilcisin L, Kayima P, Abesiga L, Portal Benitez N, Ngonzi J, et al. Out-of-pocket payment for surgery in Uganda: the rate of impoverishing and catastrophic expenditure at a government hospital. PloS one. 2017;12(10):e0187293.
68. Scott JW, Raykar NP, Rose JA, Tsai TC, Zogg CK, Haider AH, et al. Cured into destitution: catastrophic health expenditure risk among uninsured trauma patients in the United States. Annals of surgery. 2018;267(6):1093-9.
69. Bakeera SK, Wamala SP, Galea S, Peterson S, Pariyo GW. Community perceptions and factors influencing utilization of health services in Uganda. J International journal for equity in health. 2009;8(1):25.
70. Van Doorslaer E, O'Donnell O, Rannan-Eliya RP, Somanathan A, Adhikari SR, Garg CC, et al. Effect of payments for health care on poverty estimates in 11 countries in Asia: an analysis of household survey data. 2006;368(9544):1357-64.
71. Surgery TLCoG. Global Indicator Intiative 2015 [Available from: https://www.lancetglobalsurgery.org/indicators.
72. Creese A, Kuznets J. Lessons from cost recovery in health: forum on health sector reform. WHO/SHS/NHP/95.5. Geneva: World Health Organization; 1997.
73. Preker AS, Langenbrunner J, Jakab MJSR. Rich-poor differences in health care financing. 2002;21.

74. Xu Y, Ma J, Wu N, Fan X, Zhang T, Zhou Z, et al. Catastrophic health expenditure in households with chronic disease patients: A pre-post comparison of the New Health Care Reform in Shaanxi Province, China. PLoS One. 2018;13(3):e0194539.
75. Bovbjerg RR. Covering catastrophic health care and containing costs: preliminary lessons for policy from the US experience. World Bank. 2001.
76. Leighton CJWD. Strategies for achieving health financing reform in Africa. 1996;24(9):1511-25.
77. Gilson L, Doherty J, Lake S, McIntyre D, Mwikisa C, Thomas S. The SAZA study: implementing health financing reform in South Africa and Zambia. J Health policy planning. 2003;18(1):31-46.
78. Sulla V, Zikhali P. Overcoming Poverty and Inequality in South Africa: An Assessment of Drivers, Constraints and Opportunities. Washington, DC: World Bank Group, 2018.
79. Keeton C. Bridging the gap in South Africa. World Health Organization; 2010.
80. Mcintyre D, Bloom G, Doherty J, Brijlal P. Health Expenditure and Finance in South Africa: Health Systems Trust

The World Bank 1994 [Available from: https://www.hst.org.za/publications/HST%20Publications/hstefsa.pdf.
81. McIntyre D, Thiede M. Health care financing and expenditure: pooling of resources and purchasing of health care. J South African health review. 2007;2007(1):35-46.
82. Health NDo. National Health Insurance Bill (B11-19) 2019 [Available from: https://www.gov.za/sites/default/files/gcis_document/201908/national-health-insurance-bill-b-11-2019.pdf.
83. Province WC. Cape Town Metropolitan Municipality 2012 [Available from: https://www.hst.org.za/publications/District%20Health%20Barometers/24%20(Section%20B)%20Western%20Cape%20Province.pdf.
84. Town CoC. Official Suburbs 2019 [Available from: http://odp.capetown.gov.za/datasets/official-suburbs.
85. Health NDo. Uniform Patient Fee Schedule. South Africa; 2018.
86. Change TPiGSaS. World Bank World Development Indicators: Risk of impoverishing expenditure for surgical care (% of people at risk) 2018 [Available from: https://data.worldbank.org/indicator/SH.SGR.IRSK.ZS.
87. Change TPiGSaS. World Bank Development Indicators: Risk of catastrophic expenditure for surgical care (% of people at risk) 2018 [Available from: https://data.worldbank.org/indicator/SH.SGR.CRSK.ZS.
88. Kools L, Knoef M. Health and the marginal utility of consumption: Estimating health state dependence using equivalence scales. Netspar Academic Series. 2017.
89. Bloomenthal A. Marginal Utility: Investopaedia; 2019 [Available from: https://www.investopedia.com/terms/m/marginalutility.asp.
90. Masiye F, Kaonga O, Kirigia JM. Does user fee removal policy provide financial protection from catastrophic health care payments? Evidence from Zambia. PloS one. 2016;11(1).
91. Weraphong J, Pannarunothai S, Luxananun T, Junsri N, Deesawatsripetch S. Catastrophic health expenditure in an urban city: seven years after universal coverage policy in Thailand. J Southeast Asian J Trop Med Public Health. 2013;44(1):124-36.
92. Choi J-W, Cho K-H, Choi Y, Han K-T, Kwon J-A, Park E-C. Changes in economic status of households associated with catastrophic health expenditures for cancer in South Korea. 2014.

93. Group AS. Catastrophic health expenditure and 12-month mortality associated with cancer in Southeast Asia: results from a longitudinal study in eight countries. BMC Medicine. 2015;13(1):190.
94. Azzani M, Yahya A, Roslani AC, Su TT. Catastrophic health expenditure among colorectal cancer patients and families: a case of Malaysia. Asia Pacific Journal of Public Health. 2017;29(6):485-94.
95. Burger R, Christian C. Access to health care in post-apartheid South Africa: availability, affordability, acceptability. J Health Economics, Policy, Law. 2020;15(1):43-55.
96. Omotoso K, Koch SF. South African trends in medical aid coverage and stated healthcare-seeking preferences: 2004–14. Development Southern Africa. 2017;34(5):575-92.
97. Steele SJ, Sugianto H, Baglione Q, Sedlimaier S, Niyibizi AA, Duncan K, et al. Removal of user fees and system strengthening improves access to maternity care, reducing neonatal mortality in a district hospital in Lesotho. 2019;24(1):2-10.
98. Lagarde M, Barroy H, Palmer N. Assessing the effects of removing user fees in Zambia and Niger. Journal of health services research policy. 2012;17(1):30-6.
99. Ataguba JE, Akazili J, McIntyre D. Socioeconomic-related health inequality in South Africa: evidence from General Household Surveys. International journal for equity in health. 2011;10(1):48.
100. Bogart LM, Chetty S, Giddy J, Sypek A, Sticklor L, Walensky RP, et al. Barriers to care among people living with HIV in South Africa: contrasts between patient and healthcare provider perspectives. AIDS care. 2013;25(7):843-53.
101. Andersson LM, Schierenbeck I, Strumpher J, Krantz G, Topper K, Backman G, et al. Help-seeking behaviour, barriers to care and experiences of care among persons with depression in Eastern Cape, South Africa. Journal of affective disorders. 2013;151(2):439-48.
102. Chu KM, Naidu P, Hendriks HJ, Nash J, Coetzee FJ, Esteves M, et al. Surgical care at rural district hospitals in low-and middle-income countries: an essential component of universal health coverage. 2020.
103. Brink AS, Koch SF. Did primary healthcare user fee abolition matter? Reconsidering South Africa's experience. J Development Southern Africa. 2015;32(2):170-92.
104. Koch SF. User fee abolition and the demand for public health care. South African Journal of Economics. 2017;85(2):242-58.
105. Goudge J, Gilson L, Russell S, Gumede T, Mills A. Affordability, availability and acceptability barriers to health care for the chronically ill: longitudinal case studies from South Africa. BMC health services research. 2009;9(1):75.
106. South Africans are big borrowers and poor savers - expert [press release]. 5 March 2018 2018.
107. Cronjé M, Roux A. Savings culture for the black middle class in South Africa. 2010.